VOL. LXXXVI. No. 2217. [All Rights Reserved.] MAY 21, 1920. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of Postage.] PRICE SIXPENCE.

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C. 4. SUBSCRIPTION RATES, Postage Free: United Kingdom and Canada, £1 13s. 6d. per annum.; Colonial and Foreign, £2 1s. 6d. per annum.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOUVEAU & CHEVILLET, Librairie, Etrangère, 22, Rue de la Banque.
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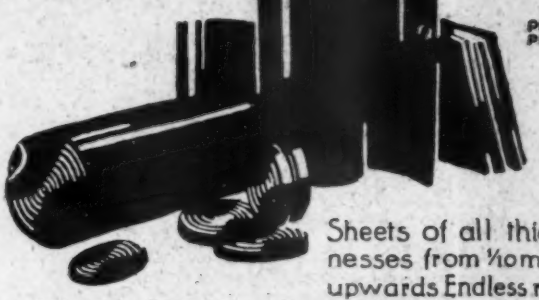

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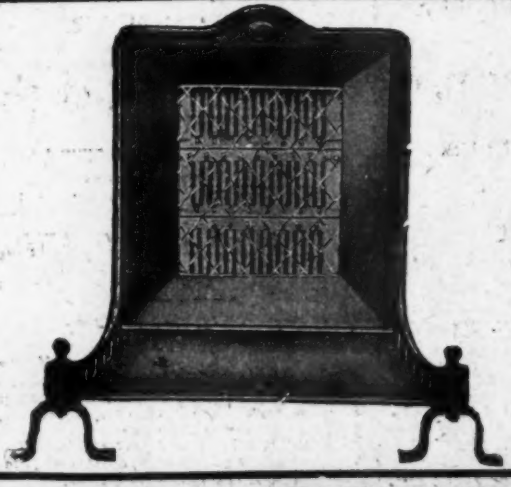

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ELECTRICAL REVIEW.

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THE RATING OF MACHINERY.

THE remarkable change in money values which has taken place during the past few years is, of necessity, causing considerable anxiety among business men throughout the country. It is a difficulty which crops up at every turn, because there are undoubtedly many cases in which serious hardships will be caused if the practice of stereotyping present values for any considerable number of years ahead is resorted to, as is threatened in some instances. The problem is a peculiarly difficult one with regard to the rating of property generally, and whilst we believe a broad view may be taken in the matter of general rating, when the quinquennial assessment is finally made this year, signs are not wanting that in relation to the rating of machinery, the full pound of flesh will be demanded.

An important principle is at stake here, because conditions are so fluctuating that whilst he would be a rash person who would foretell any fall in the cost of labour, nevertheless the ordinary laws of economics will almost certainly come into play to bring about reductions in other directions, yet what do we find some assessment authorities doing in the matter of machinery assessments? The new valuation lists have not yet been prepared throughout the country, but it is known that in some instances where they have been prepared, the assessments have been doubled and even trebled. Hasty action of this sort is seriously to be deprecated, and we can only imagine it is based on the principle which was so strongly put forward in connection with the Profiteering Act, that a man could not be said to be profiteering if he charged for an article a price based on the cost of replacing it. If the basis of the new assessment is to be the replacement value of all existing plant, then, indeed, will an intolerable burden be placed upon industry, and every step must be taken to bring that point before the various Unions.

We are aware that the authorities in London are averse to stereotyping future legislation too much upon present conditions, but although it may be said that a new valuation will be made in five years' time, our knowledge and experience of rating authorities is such that we would rather not have the trouble and expense of arguing the case for a reduction at the next quinquennial valuation. One of the leading valuation authorities in London recently, before a Parliamentary Committee, expressed the view that values would eventually settle down at about 70 per cent. above the figures of 1914, and that is a long way from the 200 and more per cent. which we are informed is being placed upon existing assessments by some authorities. There is need for concerted action, and it is satisfactory to note that the Machinery Users' Association is keenly alive to the injustice which may well be perpetrated unless a watchful eye is kept upon rating authorities as a whole. Unhappily, it is no uncommon thing for Government Departments to differ, and although there is a desire on the one hand on the part of Departments which have not to collect taxes, to go warily, on the other hand, it cannot be overlooked that in giving evidence before the Select Committee on War Wealth, the officials of Somerset House expressed the view that values in future should be

taken on the present basis. From more than one point of view that is undeniably an unsound doctrine, desirable though it may be from the tax-collector's point of view.

In the first place, such an expression of opinion will inevitably react upon the authorities throughout the country, without investigation of the premises upon which it was based, or the circumstances in which it was offered to the Committee. More important than that, however, is the position in which manufacturers and machinery users will be placed where, as is the case almost invariably, plant exists which was bought several years ago. This merely serves to emphasise the serious position of machinery users. Much plant bought years ago can only be replaced or repaired at a very high cost, and under great difficulties even then. The result is that, if assessments are to be made upon present values, there will be a large amount of partly worn-out machinery standing in books at excessive values. In the present condition of trade, every encouragement should be given to machinery users to put their works in good order, quite apart from the general unsoundness of the policy of stereotyping the future upon a condition of affairs which must inevitably change for the better to some extent within the next few years. There ought clearly to be a differentiation between machinery, and the purchase price, with an adequate allowance for depreciation, is the only logical and sound basis.

An Epoch-Marking Paper.

THERE is, it must be confessed, a certain lack of distinction about many of the I.E.E. papers; while they are often of very great technical interest and value, they seldom touch that pitch which, like Duddell's lecture on the arc, arouses the audience to enthusiasm and marks a day with a red letter in the annals of science. But on Thursday last week Mr. Sydney Evershed, whose papers are rare but always superlatively good, once more came forward with a masterpiece of scientific literature, worthy to rank with the most noted essays on electrical science that the Institution has been privileged to hear. Indeed, in the discussion, his paper was declared to do for permanent magnets what Dr. Hopkinson's did for electromagnets, in that it swept away the devices of empiricism and established the subject on a sound scientific foundation.

The paper itself was somewhat uninviting in appearance; it offered 46 pages of good hard reading, on a subject with which the majority of the audience had little direct association. But the lecture which the author delivered, without the aid of notes, put a wholly different complexion on the matter. Lucidly expressed, and relieved by sparks of dry humour, it lightly traversed the whole field of the 20 years' work embodied in the paper, and leading on from molecular theory to experimental study, finally made it clear that the author had found a key to the secrets of permanent magnetism—a key which all the time had been hanging on the nail, so to speak, awaiting someone with the patience and insight that would enable him to see it.

While we cannot do full justice to Mr. Evershed's illuminating lecture, or to his monumental paper, we give elsewhere a report of the proceedings; and in congratulating him upon a great achievement, we may assure him that the "practical" paper which he has promised will be awaited with the keenest interest and anticipation.

The Chitty Motor.

IN our issue of October 10th, 1913, we drew attention to four motors installed at the printing offices of Messrs. United Newspapers, Ltd., which for five years had been driving two big Hoe presses. We pointed out that these motors differed in many respects from current practice, but most of all in the remarkable output obtained in comparison with their dimensions and weight, each giving 120 B.H.P. at 230-650 R.P.M., and weighing 30 cwt. They gave complete satisfaction to the mechanical superintendent of the company, Mr. G. W. Mascord, and ran at a safe temperature. Moreover, their cost to manufacture was extremely low. We urged that, in the best interests of the electrical industry, full advantage should be taken of the possibilities of improvement in output for weight and size that were evidently still far from exhausted.

Those motors were built by the Rees-Roturbo Manufacturing Co., Ltd., to the designs of Mr. Henry Chitty. As we fully anticipated, the accuracy of our statements was immediately challenged, but we did not ask our readers to accept them blindfold; we urged them to go and see the machines themselves. The correspondence which ensued ran on for many weeks, without in the least modifying the fact that the machines were solid realities and fulfilled the claims we made for them.

Had not the war intervened, the manufacture of machines of this type would, doubtless, have been developed. Over six years have passed, and the subject—so far as publication is concerned—has lain dormant, but not forgotten; we have looked forward to the resumption of activity in this quarter, and we are gratified now to be in a position to say that production has commenced, and arrangements are in progress for the manufacture of these motors and dynamos on "mass production" lines. Last week we had the pleasure of seeing two machines running on load; they were similar machines, on the Hopkinson—or rather, the Kapp—test, one acting as motor, and the other as generator, and the losses being supplied electrically by a third machine of another make. The normal rating of both machines was 500 amperes at 220 volts, 1,440 R.P.M.; they ran without sparking or undue heating, both at normal load and with 660 amperes on the motor, which load was thrown on and off repeatedly without effect on their behaviour. The weight of each machine, including its bedplate, was 1,750 lb., and its dimensions were correspondingly small. The normal input to the motor was 110 KW., and the mean efficiency 93 per cent. The specific weight was 17 lb. per KW.

These figures speak for themselves to the expert; for those who are not dynamo designers, we may say that the output is more than twice that usually expected from machines of this size—like that of the machines we described in 1913.

The Ayton Presentation.

IT was with great pleasure that we took part in the recognition by the electric vehicle industry of the splendid work that Mr. Frank Ayton has accomplished as founder, hon. secretary, and, finally, chairman of the Electric Vehicle Committee; a report of the proceedings at the dinner at which he was the guest of honour is given in our "Notes" columns to-day. The excellent progress that has already been achieved in the face of innumerable obstacles was fully recognised by the speakers, but the keynote of the speeches was the magnificent prospect that lies before this branch of the electrical industry. Never before has its future been so rosy. The eight-hour day has sealed the fate of horse traction, petrol is continually growing dearer and scarcer, and the electric vehicle is going to be the saviour of the situation. Moreover, the Electricity Commissioners have announced their intention of encouraging the use of electric vehicles, by granting powers to corporations to establish garages and charging stations; this is the supreme need of the industry, which has always been hampered and restricted in its development by the lack of charging facilities.

In its early days the industry suffered from recurring attempts, not so much to establish a sound business as to exploit the investing public, but those times, we hope, are past; the industry is now in the hands of men who are determined to establish it on a firm industrial basis, it has before it an unexampled opportunity, and we look forward to an immense development in the near future.

THE KINGSTON-UPON-THAMES ELECTRICITY WORKS.

It will be remembered that during the Municipal Electrical Convention of June, 1913, members of the M.E.A. visited the riverside borough on the completion of extensions to the electricity works which cost about £15,000. The new plant, which we described at the time,* was inaugurated in September, 1913, and was said to be practically the first of its kind to be installed in this country. Two Diesel engine sets of the M.A.N. it was decided to be less costly to install another Diesel set rather than to keep boilers banked during the day. A two-cycle engine was selected, which in addition to stand-by duties, assisted the old steam plant on peak loads. During the year ended March 31st, 1918, the steam plant generated 939,122 units at a fuel cost of £9,183, or 2.346d., while the Diesel engines generated 746,913 units at a fuel cost of £1,942, or 0.623d. per unit sold.

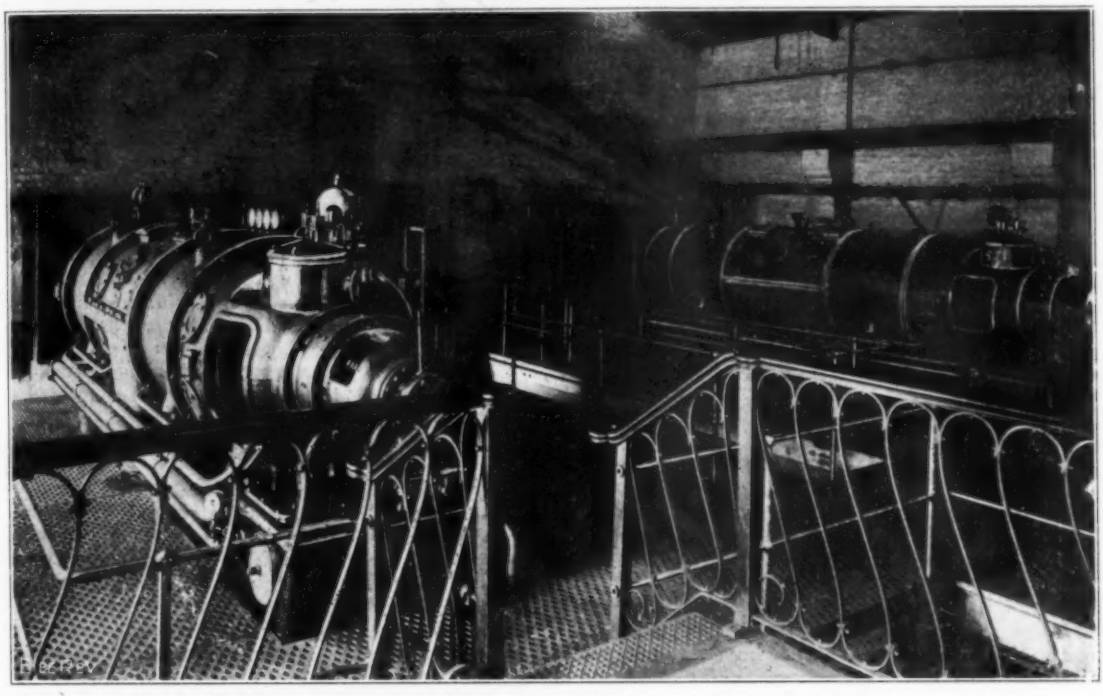


Fig. 1.—Ljungström Turbo-alternators at Kingston-upon-Thames.

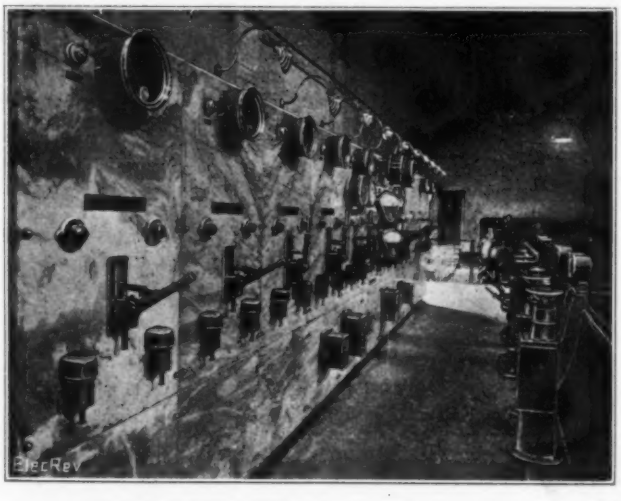


Fig. 2.—Crompton Three-phase Switchboard.

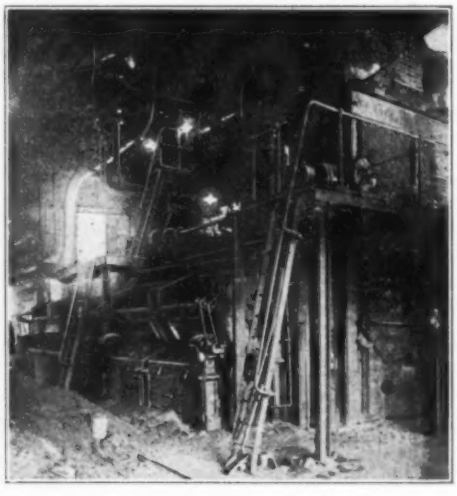


Fig. 3.—Stirling 21,000-lb. Boilers.

type, each coupled to a Siemens 270-kw. flywheel alternator, were installed, the intention being to decrease fuel costs and wages and repair costs in the boiler house.

One 4-cycle set with a low fuel consumption took the whole load of the station for an average of 16 hours per day, the boilers being shut down entirely during such hours. In order to obviate the risk of stoppage,

Following the strenuous war period, like many other undertakings of the kind, considerable trouble was experienced with the plant, and several breakdowns occurred in the latter part of 1918. Due to the heavy overload to which the plant had been subjected, a serious breakdown eventually occurred in December, 1918; to aggravate matters, some of the station employés struck work about the same time, and a total suspension of the supply seemed inevitable. However,

* Electrical Review, June 13th, 1913.

Mr. T. A. Kingham, together with his assistant and one or two representatives of the Brush Electrical Engineering Co., Ltd., commendably set to, and by working continuously through the holidays from December 24th to January 1st, managed to get part of the new turbo-generator plant, which was then being delivered, into commission, and were thereby able to maintain the supply. Owing to the non-delivery of the E.H.T. switchboard and gear the station was for three months successfully run and controlled from the temporary 3,300-volt, 3-phase switchboard, fig. 5, which was erected during the above-mentioned holidays.

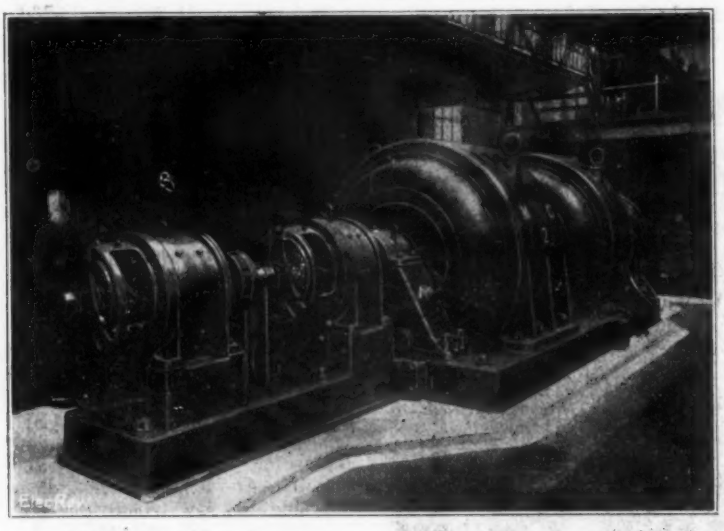


FIG. 4.—A 1,000-KW. FREQUENCY CHANGER.

In February, 1918, owing to the constantly increasing demand for power for munition works, the Town Council entered into an agreement with the Ministry of Munitions, which had approved of a 3-phase scheme prepared by Mr. J. E. Edgecombe, the then borough electrical engineer, and now consulting engineer to the Corporation, and the sanction of the Local Government Board was obtained to a loan of £25,000 for a period of 20 years at 6 per cent. for the purpose of purchasing additional electrical plant and equipment. The new installation consisted of two water-tube boilers, buildings and accessories; two 1,000-KW. steam turbo-alternators, with the necessary engine-house plant; and switchgear, distributing plant, and sub-station transforming gear. The first instalment of the new plant, consisting of a 1,000-KW. turbo-generator set, was put to work as stated above in January, 1919; a duplicate set was installed in June, and the boilers were finally completed in July of the same year. It is interesting to note that in spite of the conditions under which the first set was put into commission it ran continuously from January 1st to March 31st, 19' with but a single two hours' rest for the purpose of cleaning out the condenser.

FIG. 5.—TEMPORARY E.H.T. SWITCHBOARD AT KINGSTON.

The Kingston-upon-Thames public supply was until recently entirely single-phase, 77 periods, generation being at 2,100 volts, and the pressure at consumers' terminals, who were supplied through stepdown transformer sub-stations and pillars, was 105 and 210 volts. The single-phase generating plant consists, in addition to the two Diesel sets, of a number of Belliss steam reciprocating sets coupled to Siemens disk-type alternators. In the recent extensions, particulars of which are given in what follows, and which we recently had the pleasure of inspecting, a breakaway has been made from single-phase generation, and a 3-phase system introduced. This has necessitated a link between the two systems in the shape of two 1,000-KW. frequency-changing motor generators, which form the most interesting portion of the new plant. The new generating plant consists of two Brush-Ljungstrom turbo-alternators, fig. 1, each capable of developing 1,000 KW. The turbines, which are of the double-rotation radial-flow type, operate at a steam pressure of 200 lb. per sq. in., and 200 deg. F. of superheat. The steam consumption at full load is 12.5 lb.; at ¾ load, 13.1 lb.; and at ½ load, 14.7 lb.

The two alternators of each set, which generate 3-phase energy at 3,300 volts and 50 periods, are identical in construction, and both run at 3,000 R.P.M., but in opposite directions. From the point of view of switchgear, &c., both machines are considered as a single set, the stator windings being connected in parallel. The series-connected field windings are energised from a single exciter mounted on the end casing of one of the alternators. The rotors each consist of a solid steel forging. Axial ventilation is used throughout the machine, and both stator and rotor are mica insulated. The complete turbo-alternator is carried by its condenser, which is of the surface type, and is bolted direct to the flange of the exhaust branch of the turbine. Each turbo-generator has its own "Sirocco" air washer of the water-spray type, and its own set of Edwards air and Pulsometer circulating pumps. The condensers are on the station floor level while the turbines are on a platform on the switchboard gallery level.

The two new Stirling boilers are each capable of evaporating 21,000 lb. from and at 212 deg. F. They are fitted with B. & W. chain grate stokers, and work in conjunction with a Green economiser. The feed pumps are of the turbine type, and their exhaust steam is used to raise the temperature of the feed water prior

to its delivery to the boilers. All water, which passes through a Bracket rotary screening plant, fig. 7, is drawn from and returned to the river Thames. Some very excellent results are being obtained with the very low-quality fuel that is being burnt; at present coke breeze with a calorific value of 8,000 B.TH.U. per lb. is being used. This is wheeled by means of hand trucks from the stock yard over a weigh bridge, and dumped before the boilers. It is then shovelled by hand into the hoppers. It is hoped at a later date to install coal-handling plant which will greatly facilitate the stoking arrangements.

The new three-phase switchboard, fig. 2, and switch-gear was manufactured by Messrs. Crompton & Co., of Chelmsford, and Messrs. Lucy & Co., of Oxford, to the order of Mr. J. G. Statter. The new board is composed of handsome grey marble panels, the synchronising panel being placed in the centre, on either side of which are located the turbo-generator and motor-generator panels, and on the outsides the feeder panels.

The 1,000-KW. frequency-changing sets consist each of five machines as follows: A single-phase alternator, a three-phase synchronous motor, a starting motor, and two exciters, one for the alternator and the other for the synchronous motor. The two exciters are provided because the voltage of each synchronous machine has to be controlled by a Tirrill regulator. The single-phase alternator has a capacity of 1,000-KW. at 2,100 volts and 75 periods, with a power factor of 0.8, and is capable of carrying a 25 per cent. overload for two hours. The three-phase, 1,450-H.P. motor, driven from the turbo-alternators, works at a pressure of 3,300 volts, 50 periods, at unity power factor. The slip-ring starting motor operates from the 3,300-volt, 50-period circuit, and is provided with a liquid starter. The complete set, figs. 4 and 6, runs at 750 R.P.M., the machines being mounted on a common bedplate with a flexible coupling between the two exciters. The three main bearings are forced lubricated, the oil being pumped by a gear pump driven from the shaft of one of the exciters; no oil cooler is fitted.

Special attention was given to the complicated problem of parallel running in connection with these sets, the conditions being as under: (*a*) The sets must run in parallel with each other on both the three- and single-phase sides; (*b*) the three-phase motors must run in parallel with the two turbo-generator sets; (*c*) the single-phase alternators must run in parallel with the Diesel and old Belliss reciprocating sets; (*d*) the load must be adjustable between the sets.

The construction of the two synchronous machines is generally the same throughout. The stator core in each case is supported between two clamping rings keyed into a cast-iron frame. It is built up of iron segments, varnished on both sides, and held in position by steel dove-tailed keys screwed to inwardly projecting ribs on the cast-iron frame. The former-wound coils were completely insulated before being placed in the core, and mica was used as the insulation between turns for the whole length of the coils; mica tubes insulate the coils on the slot portion and oiled linen and mica on the end winding. Before the outer insulation was put on the whole coils were dried under vacuum, and then impregnated with a solid compound. The mica tubes were then moulded on under pressure to ensure a solid coil and eliminate air spaces. The arrangement of the winding is such that the voltage between adjacent conductors is a minimum. A single steel casting forms the poles and hub of each rotor, the laminated pole shoes being screwed on after the coils were placed in position. A heavy amortisseur winding is provided in the pole face. Bare copper strip of heavy section wound on edge, and assembled under hydraulic pressure form the field coils. Duplicate sets of carbon brushes in box-type holders are provided for the gun-metal slip rings. In order to keep the peripheral velocity within safe limits, owing to the high speed at which the sets run, very long machines were necessary.

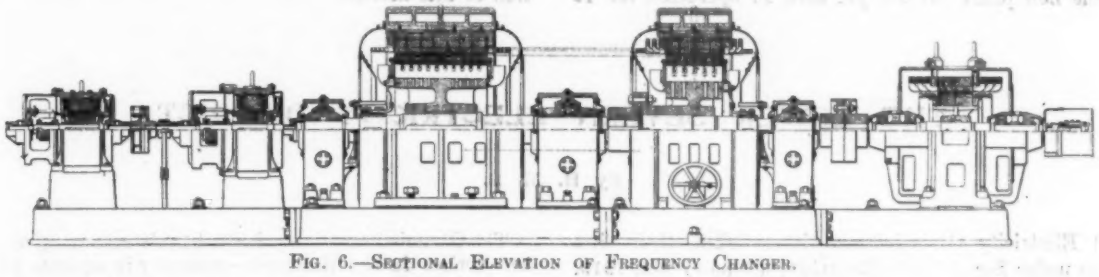


FIG. 6.—SECTIONAL ELEVATION OF FREQUENCY CHANGER.

To ensure a supply of cool air to the centres of the machines fan blades are fitted on the rotor hub with a baffle attached to the solid end shields. Further, axial holes are provided right through the stator core in addition to the usual radial vents; holes are also drilled through the rotor hub. The motor stator is carried on rollers mounted on ball bearings, and a racking gear is provided to enable the stator position to be adjusted to assist in paralleling or adjustment of load.

It was not possible to carry out exhaustive tests at the time these sets were built, as they were urgently required. They were, however, erected at the builder's works, and run for about two hours. They were then sent to Kingston, and, after erection, were put at once into service, and ran continuously day and night without any adjustment.

FIG. 7.—WATER SCREENING PLANT.

The whole of the turbo-generator plant, with condensers, pumps, and auxiliary plant, as well as the frequency changing sets, was constructed by the Brush Electrical Engineering Co., Ltd., of Loughborough, to

the specification of Mr. J. E. Edgecombe, who on his resignation in September, 1918, was appointed consulting engineer. The extensions were carried on by his chief assistant and successor, Mr. T. A. Kingham, under whose management the undertaking now is.

Striking results have followed on the discarding of the old plant. Last year the units sold numbered 1,750,000, and this year it is estimated that they will reach 2,500,000. It may be pointed out that only on two occasions in the history of the undertaking has a surplus been shown on the "year's" working. It will be remembered that last year there was a deficit on the undertaking of £6,000; this year, although the whole of the new plant has not yet been in operation for 12 months, that loss has been converted to a surplus of £2,500.

The demand for power has grown to such an extent that further extensions will be necessary in the near future, and it is intended to do away with the whole of the old B. & W. boiler plant and Belliss-Siemens reciprocating steam sets, and to install in its place 3-phase turbo-generating plant. The flexibility and convenience of the 3-phase system of supply is recognised, and the old single-phase system is to be eliminated entirely from all future development.

In conclusion, we are indebted to Mr. T. A. Kingham, borough electrical engineer, for facilitating the preparation of this article.

THE LOWER SEVERN ELECTRICITY DISTRICT.

By H. M. S.

THE Electricity Commissioners have taken their first action under Sec. 5 of the Electricity (Supply) Act, 1919, by issuing a notice in the terms of Sub-sec. (1) and (2) of that Section, that they have provisionally determined that the area shown on the map shall be constituted a separate electricity district, to be known as the Lower Severn Electricity District, and that it being apparent to the Commissioners that the existing organisation for the supply of the district should be improved, they intend to hold a local inquiry into the matter. They invite authorised undertakers, local authorities, and other parties concerned to forward objections or representations on account of the inclusion or exclusion of any area in or from the proposed district, and also invite such parties as are mentioned in Sub-sec. (2) to submit in writing schemes for effecting such improvement in the existing organisation, including the formation of a joint electricity authority for the district. The time limit for the receipt of the objections, representations, or schemes, is July 31st, 1920.

This first action is of considerable interest as an indication of the policy which the Commissioners have adopted, but it cannot be taken as a binding precedent, as the Section referred to permits them to take a somewhat different course to that adopted in this first case.

Sub-section (1) says that the Commissioners may provisionally determine that a district shall be constituted, and that before finally determining the area to be included, notices of the intention shall be published and given to the County Councils, local authorities, and authorised undertakers in the district, and if any objection or representation is made on account of the inclusion or exclusion of any area, the Commissioners shall hold a local inquiry with reference to the area of the district.

Sub-section (2) says that where it appears to the Commissioners that the existing organisation for the supply of electricity within a district provisionally determined should be improved, the Commissioners shall give notice of their intention to hold a local inquiry into the matter, and shall give to authorised undertakers, County Councils, local authorities, railway companies using or intending to use electricity for traction purposes, large consumers of electricity, and other associations or bodies which appear to be interested, an opportunity to submit a scheme or schemes for effecting an improvement, including proposals for altering or adjusting the boundaries of the district, and for setting up a Joint Electricity Authority.

It is provided that the area of the district shall not be finally determined until after the inquiry into the improvement of the organisation for supply has been held.

It will be seen that the notice under Sub-Section (2) cannot be given until a district has been provisionally determined, but that it need not be given at the same time, or, indeed, within any prescribed time.

The Commissioners have chosen in this case to give the two notices in one document—naturally in separate paragraphs following the wording of the Act—and to name the same date for the receipt of (*a*) objections to the delimitation, (*b*) schemes for the improvement of the supply organisation.

This may be taken as showing the disposition of the Commissioners to save time, and to meet the convenience of those interested by making one local inquiry serve the two purposes of dealing with objections and representations concerning the area, and with schemes for the improvement of the supply. As the definitive delimitation of the area can only be made after the local inquiry for the second purpose, and as objections on that matter can be brought up then, it appears that the Commissioners will be able to eliminate the local inquiry dealing only with questions of area.

This action of the Commissioners may rather startle regular civil servants and legal advisers of Government Departments as taking a liberty with an Act of Parliament, but any formal objection of that kind can be easily met by a formal division of the one inquiry into two parts, if thought desirable. As there is no limitation to the persons or bodies who may submit objections to the area, whilst there is a limitation—though one which is very wide—to those who may submit schemes, such a division may be convenient. But if there are no objections to the area, no inquiry on that is required by the Act.

Whatever views may be taken by the formalist, everyone concerned will be grateful to the Commissioners for their evident desire to concentrate and shorten the proceedings.

It may be noted that the Commissioners may (not shall) make rules to govern the holding of these inquiries and the costs thereof. No such rules have yet been published, so that little can be said about the procedure. Presumably some rules, sufficient to guide the parties interested, will be made known in good time. The Commissioners may require any person to attend as a witness, give evidence, and produce documents under penalty for failure without reasonable excuse.

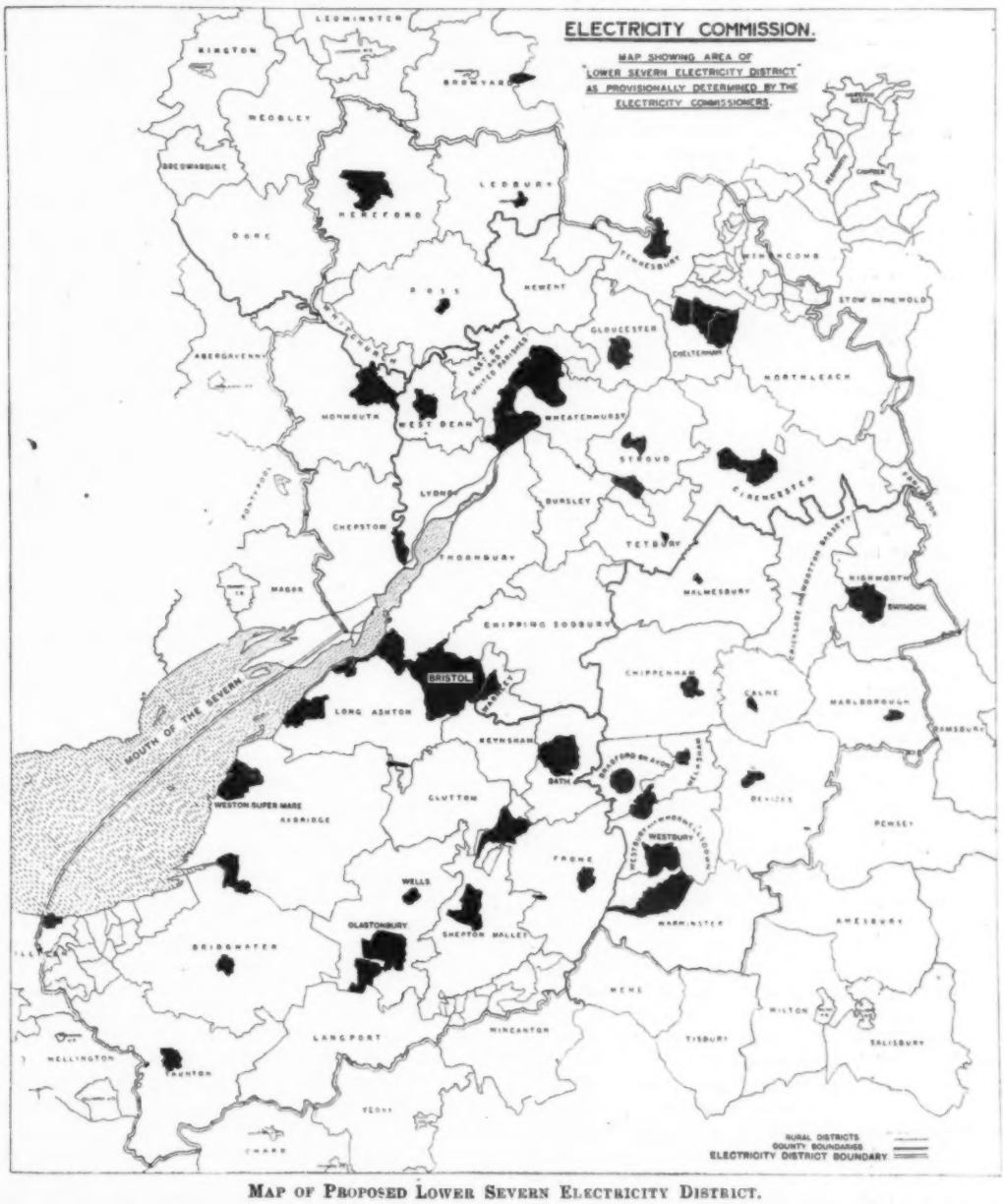
To come back to the Lower Severn District, the curious may wonder why this district has been selected for the first action. No doubt the same question would have occurred to them had any other district been selected. The Commissioners have to start somewhere, and they may even have made the selection by lot. But it is perhaps not unconnected with the choice made that some of the authorised undertakers in the district, on the initiative—it is believed—of Mr. Faraday Proctor, have been getting together and discussing the formation of a joint electricity authority. The Commissioners may have thought this evidence of the spirit of co-operation a good omen for a satisfactory arrangement, which they naturally desire to achieve by their first essay. If the inquiry shows a general desire to co-operate and an absence of the jealousies which sometimes exist between neighbouring authorities, it will establish a good example which will have effects in other areas.

The area delimited provokes a more useful line of inquiry. Its extreme dimensions are about 75 miles, north and south, by 50 miles east and west, covering somewhat over 2,000 sq. miles. Excepting for the eastern bank of the Severn between a point about 9 miles east of Minehead, and one opposite the mouth of the Wye, which forms about half the length of the western boundary of the district, the boundaries do not coincide with any particular topographical features, or with county boundaries as a rule, though the boundary of Gloucestershire, with Worcestershire and Oxfordshire, is followed for some distance.

Gloucestershire is the only whole county in the area, which otherwise covers parts of Herefordshire, Monmouthshire, Wiltshire, Somersetshire, and some small parts of Worcestershire detached in Gloucestershire. The shape of the area also shows that it has not been determined by simple geometry. The most likely suggestion is that consideration has been given to the position of existing or projected large stations, and the distances to which they can economically supply. Colour is given to this idea by the obvious fact that the only large generating station in the area is Bristol, and that the Severn bank offers fuel and water facilities for a super-station. Bristol is not exactly central to the area, but nearly enough so to suggest that that is the vicinity contemplated for the supply centre. If one takes population as indicating potential demand, Bristol is much more central with reference to this than with reference to area.

One remarkable feature of the district is that it covers territory with a very wide range of character with respect to industries and density of population. Bristol, with its port of Avonmouth, is a busy manufacturing and shipping district. None of the other towns have any considerable industries, excepting Swindon, with its railway shops. Gloucester also has some factories. Some of the smaller towns, such as Frome, Bridgwater, and Westbury, have some old-established industries, mostly of small magnitude individually. Most of the other towns in the area are of the quiet market-town and residential type, such as Bath, Cheltenham, Hereford, Wells, and Marlborough. The anticipated development of shipbuilding in the erstwhile national yards on the Wye will change that district when the development is realised. But by far the greater part of the area is rural, much of it pastoral. Without statistics at hand, one does not care to hazard figures of population density, but has a general impression that it is a pleasant, quiet, uncrowded, country-holiday sort of territory. Weston-super-Mare is, of course, a popular seaside resort.

(To be concluded.)



Map of Proposed Lower Severn Electricity District.

The Proposed Capital Levy.—On May 12th the Executive Committee of the Federation of British Industries instructed the Taxation Committee of the Federation to oppose by all means in its power any suggestion of a capital levy on so-called war wealth.

ELECTRICITY SUPPLY AUTHORITIES AND THE LAW OF RATING.

By W. VALENTINE BALL, O.B.E.

This being the year of the quinquennial valuation, those who are interested in the supply of electricity will sooner or later be getting into touch with the rating authorities.

Even in normal times, there are reasons why a revaluation is necessary and desirable once in five years; but much of an extraordinary character has occurred since last there was a valuation. The cost of generating electricity has gone up by leaps and bounds; special legislation has enabled lighting authorities to increase their charges; while various Acts of Parliament passed by a legislature which, in the exigency of the times, was bound to find revenue, has laid charges upon this as upon many other forms of industry. In these circumstances a brief review of the principles of the law of rating as it applies to electrical undertakings may be found acceptable.

To ascertain the rateable value of an ordinary dwelling house is a comparatively simple matter. The overseers are required, in making the new valuation list, to fix the gross value of all properties in the borough at an amount corresponding to the annual rent which the tenant might reasonably be expected, taking one year with another, to pay for the premises, if the same were let on an annual tenancy, and the landlord undertook to bear the cost of repairs.

When, however, we come to consider a highly complicated piece of property like an electricity supply undertaking, the ascertainment of the hypothetical rent is by no means a simple matter.

As such a person as an actual "tenant" of an electricity supply undertaking is a creature unknown, it has long been the practice, in rating gas companies and similar undertakings, to have regard to the profits which such a concern would bring in. Three leading principles of law are as follows:—

(*a*) In valuing the works, mains, &c., of an electricity supply company for the purposes of rating, the profits earned by the company are taken into account.

(*b*) The exercise of the right to lay down wires and send electricity through them, amounts to an occupation in law and so is rateable.

(*c*) If the electricity works belong to a municipal corporation or other local authority, that body is rateable, although the profits earned are devoted to public purposes.

Let us now examine the method by which the rating authorities endeavour to ascertain the hypothetical rent.

The first step is to ascertain the net receipts. This is done by taking the receipts of the company from every source, and subtracting therefrom the ordinary working expenses (other than the cost of repairs, insurance, &c., which come in later on). The very substantial items coal and wages would, of course, be deducted. Having ascertained the net receipts, it is necessary to inquire how much of them a tenant would be willing to pay as rent to a hypothetical landlord. He would not, of course, pay the whole receipts as rent, as he would not then have any incentive to embark on the undertaking. There must be a deduction for "tenant's profit," sometimes called "tenant's share." It is worked out as a percentage on the tenant's capital. The tenant's capital is the value of his loose stock-in-trade, and a sufficient capital sum to enable him to provide for working expenses. It would not, of course, include the value of the boilers, engines, dynamos, or other fixed machinery at the generating station, but it would include the meters on consumers' premises, and all the loose tools, &c. A percentage is then taken on the tenant's capital, and considerable difficulty is often experienced in deciding what this should be. At the London Quarter Sessions the usual practice in rating the property of a gas company is to take 5 per cent. for interest, 10 per cent. for trade profits, and 2½ per cent. for risks and casualties, making 17½ per cent. in all.

Having deducted the tenant's profit, we arrive at the gross value of the undertaking. According to the rule laid down in Statute (*supra*), the cost of repairs, renewals, and insurance sufficient to maintain the hereditament in a state to command the rent must be deducted from this, inasmuch as these charges fall on the hypothetical landlord. Making a final deduction of the rates, which the tenant has to pay, we arrive at the rateable value of the whole undertaking.

In London, as the rates are only revised once in five years, it is necessary to determine what year is to be considered for the purposes of rating.

Hitherto we have proceeded upon the assumption that the entire undertaking of the company is situated in one parish or rating area. In such a case there is no necessity to consider whether the profits, upon which the rateable value is founded, are earned at the generating station or at the premises of the various consumers. But where, as nearly always happens, the undertaking is distributed over many parishes, difficult questions arise. For instance, the generating station, which is only indirectly productive, may be in one parish, while the directly productive part of the works may be distributed over the company's whole area. How are the profits to be apportioned? The difficulty is got over by considering the claims of all the different rating areas together.

In dealing with this question, rating authorities have recognised the fact that the undertaking of a gas or a water company is very similar to that of an electricity supply company. The principle adopted in the case of a water company was laid down in 1847 in the case of R. *v.* Overseers of Mile End Old Town (1847) 10 Q.B., 208. There the works of a water company extended into several parishes. The rateable value for the purposes of poor rate, of the entire works, was £30,800. The rateable value of the reservoirs, buildings, &c., valued as land and buildings deriving value from their capacity of being applied to the objects of a water company was £6,500. It was held that the rateable value ought to be apportioned among the several parishes in the following manner: "The rateable value of the reservoirs, buildings, &c., valued as above, to be first deducted from the total rateable value, and distributed among the parishes in which this portion of the works was situate, according to the extent of such works in each parish; and the residue of the rateable value to be apportioned among the parishes containing the service pipes, in the ratio of the net profits produced in each of those parishes.

Mr. C. A. Webb, in his "Law and Practice of Rating and Assessment (1910)," p. 170, points out that revenues may be thus ascertained:—

Gross receipts—		
Sale of electricity	£74,361	
Rental of meters	4,620	£78,981
Deduct—		
Generation of electricity (*a*)	19,053	
Distribution of electricity (*b*)	2,460	
Management and general expenses (*c*) ...	6,430	27,943
		£51 038

(*a*) In the item generation of electricity are included the following expenses: Coals, and other fuel, oil, waste, water, engine-room charge, proportion of salaries of manager and superintendents, wages, &c., at generating and sub-stations.

(*b*) Distribution of electricity includes the following expenses: Proportion of salaries of manager and engineers, wages, repair and maintenance of meters, and other apparatus at consumers' premises.

(c) Management and general expenses include salaries and remuneration of directors, secretary, clerks, collectors, and auditors, stationary, printing, and general establishment charges and law expenses.

Tenants' capital includes meters and other appliances at consumers' premises, tools, furniture, and five weeks' working expenses.

Rating of Works which Include Plant, &c., in Excess of Existing Requirements.

It often happens that electrical undertakings have extra space, and sometimes spare plant, which is in excess of their existing requirements, and is laid down for the purpose of meeting extensions in future years. The question whether this part of the property is to be included in the rating has been considered in a number of cases, but not electric supply cases. In R. *v.* South Stafford Waterworks, 1885, 16 Q.B.D., 359, the indirectly productive works were largely in excess of the then existing requirements of the company, and had been constructed for use in future years. The rateable value of the whole system was agreed, the point in dispute being the proper amount of deduction to be made therefrom. It was found that if only so much of the permanent works as was required for the purposes of the present supply was included in the rating, the rateable value of the whole would be materially diminished. The following passage from Lord Esher's judgment in the Court of Appeal serves to show the attitude taken up by the Court:—

"There might be works of the undertaking which had not become part of the actual system, as, for instance, a reservoir or a second lot of engines not yet used at all, but constructed with the view of becoming part of the works in the future. Such could be no part of the existing system of works, but would be intended for another system, and would, of course, be rejected in making the calculation. But that is not the case, for here every part of the works is in actual use, though they are too large for the supply of water at present required. . . . But as the works in use are in excess of the present requirement, a tenant taking the whole or part of the property in a particular parish ought not in justice to be asked to pay the same rate of rent as he would if all the works were earning profit. Therefore, if the 3½ per cent. mentioned by the arbitrator is the ordinary percentage upon the value of the capital laid out, one would think that the percentage in this case should be reduced to 3 per cent., or less." It would seem from this case that it would be perfectly proper for a rating authority to make a reduction on account of the spare space inside a generating station. The question whether there could be a reduction for a spare "set" is rather different, because prudent people would not run a large station and undertake to give a continuous supply without making provision for breakdown.

There remains to be considered an important question which has arisen in relation to excess profits duty. Is this duty to be deducted before arriving at the profit of the hypothetical tenant? It has long been recognised that income tax was not so deductable. The question arose and was decided in the case of Port of London Authority *v.* Overseers of the Parish of Chadwell St. Mary, 35 T.L.R., 84, which came before the King's Bench Division on November 13th, 1918. The Authority had been assessed by the Commissioners of Inland Revenue to pay a very considerable sum in respect of excess profits duty, which they contended should be taken into account before arriving at the profit for the purposes of rating their docks. In the course of his judgment, in which he decided that the excess profits duty should be taken into account, Mr. Justice Darling said: "I do not think that he (meaning the hypothetical tenant) could properly arrive at a good opinion as to whether he would be wise in taking the Tilbury Docks unless he did consider whether before he put anything in his pocket he would have to pay the excess profits duty; and if he said, "I will give such and such a rent without considering it," I think he is a man who might make a very bad bargain; but that is not the kind of man the Statute contemplates."

It is interesting to recall a fact noted in the Electrical Review early in 1918 that the Hendon Electric Supply Co. contested this point before the Assessment Committee at Hendon, but the decision was held over pending the decision in the above case.

THE ROYAL SOCIETY'S SOIRÉE.

On the night of May 12th a large and representative gathering of Fellows of the Royal Society and their friends assembled at Burlington House, London, on the occasion of the first of the two annual conversaziones, that confined to men only, that are held by the Society. Sir Joseph J. Thomson, O.M., D.Sc., president, received the guests. As usual on these occasions, main interest centred on the exhibition of the new scientific discoveries and developments of the year, and the keenest attention was paid to the demonstrations which took place in the course of the evening and to the inspection of apparatus, much of which was seen in operation. There were about 47 exhibits, and although few could strictly be called electrical in nature, some 13 of them employed either electricity or magnetism in one form or another. We shall confine our remarks to a brief reference to the latter exhibits.

Mr. A. A. Campbell Swinton, F.R.S., president of the Wireless Society of London, gave a short exposition (illustrated by lantern slides) of wireless telephony in connection with an experimental demonstration by Marconi's Wireless Telegraph Co., Ltd., from its works at Chelmsford. The apparatus consisted of an amplifying detector and note magnifier to which was connected a loud-speaking telephone, enabling speech to be heard all over the lecture hall. The aerial consisted simply of a 3-ft. square frame wound with a few turns of wire and placed on the lecture table in the room.

Marconi's Wireless Telegraph Co., Ltd., exhibited wireless telegraph apparatus which consisted of a marine type direction finder, transmitting and receiving valves, a double note magnifier, and auxiliary apparatus.

The Botany Department of the Imperial College of Science and Technology had on view a recording porometer which was in operation. The instrument recorded the rate at which air, under slightly reduced pressure, was drawn through the stomata (pores of a plant leaf) into a glass cup fixed on the under surface of the leaf. It thus gave a measure of the size of the pores. Each time a bubble of air so drawn in escaped from the lower tube it momentarily made contact between a column of mercury and a platinum wire; the electrical current which then passed was made to move the recording pen on the surface of a revolving drum.

Mr. A. V. Hill, F.R.S., showed thermopiles for investigating the thermal or the thermo-elastic properties of muscles. When a muscle is stimulated heat is produced in four separate stages; first, in the development; secondly, in the maintenance; thirdly, in the disappearance of the mechanical response; and lastly, in the process of oxidative recovery. The heat production is recorded by means of delicate insulated thermopiles, and a sensitive photographic recording galvanometer. When a muscle is stretched, or released after stretching, complex thermal effects are shown by the use of the thermopiles; these thermal effects throw considerable light on the mechanical and elastic properties of muscle.

Amongst the magnetic compasses illustrating recent developments that were exhibited by the Admiralty compass department were two standard types of aircraft

compasses, and examples of aperiodic compasses for use in ships and aircraft. The aperiodic system adopted in these instruments is the result of investigations of Mr. G. T. Bennett and the late Lieut.-Com. C. Campbell.

The Meteorological Office had on view new instruments and diagrams, and amongst the latter records of the magnetic disturbance of March 23rd and 24th, 1920, were shown, together with photographs of auroræ for height measurement; also records of the frequency of thunderstorms on the route between England and Australia and at selected stations in Africa and South America.

Messrs. Adam Hilger, Ltd., exhibited a vacuum concave grating spectrograph which has been specially designed for the investigation of the Schumann & Lyman regions of the spectrum. No refractive substance is introduced, but the whole spectrum is obtained with one setting of the grating by the use of two slits. A magnetically-operated shutter is provided which enables two exposures to be made.

The apparatus for air navigation that was shown by the Air Ministry Laboratory included Capt. Weir's (Littrow projection) diagram applied to the purpose of obtaining position lines from wireless telegraphic bearings, which application was suggested by Commander Veater, R.N.

Clays treated by electro-osmosis, and photo-micrographs of raw and purified clays, together with crucibles and other refractory specimens, were exhibited by the Osmosis Co., Ltd. The phenomena of electrical osmosis, whereby matter in a very finely divided state is capable of being influenced by an electrical potential, are applied in practice to the process of purification of clays. The equipment necessary to obtain osmosed clay consists of a blunger, settling tanks, and the osmosis machine. The latter is composed of a rectangular trough in which is arranged horizontally a cylindrical metal anode, which is surrounded, beneath the surface of the slip and at a short distance from it, by a laminated cathode, through which the clay slip is driven by paddles. The cylinder is made to revolve slowly, and the dried purified clay is collected by means of a scraper.

Mr. E. A. Reeves's apparatus for showing the existence of a true north and south directive force in the electricity of the atmosphere consisted of a large glass bottle with an india-rubber stopper, from which was suspended by a fibre of unspun silk a gold-leaf paper indicator. The inner side of the stopper was covered with paraffin wax, and the bottle was coated inside and out with shellac varnish, the whole being mounted on a tripod stand. On a calm, clear day if the apparatus is set up in a high open space, and screened from the direct rays of the sun, it will be found that, after the paper has been electrified by touching it with vulcanite rubbed on dry cloth, and left for some time, it will oscillate about evenly on either side of the true North and South line, or come to rest approximately in that direction.

Mr. A. Mallock, F.R.S., showed apparatus that he used in experiments to determine the variation of rigidity with temperature. The specimen to be tested formed part of a torsion balance in which the restoring couple was supplied by the torsion of a long thin wire together with that of the specimen, the latter being in the form of a short wire or narrow strip about 2 in. long. The specimen and lower part of the balance could be immersed in a tube of fluid kept at any desired temperature. The periods of oscillation were automatically recorded electrically for various temperatures, and the ratio of these periods furnished the necessary data for determining the ratio of the rigidities. In making an experiment the oscillations were maintained continuously by an electrical device, the specimen being immersed successively in water at 100 deg., at room temperature, in carbonic acid, in alcohol and in liquid air.

Major G. W. C. Kaye's collection of radiographs illustrating some recent developments in the use of X-rays for the examination of metals and other substances was of much interest. The specimens exhibited included, amongst others, Heilbron's radiographs of paintings by old masters, from an examination of which it was clearly apparent that some of the figures depicted in the original had been painted out or modified at a later date.

The Royal Observatory at Greenwich had on view transparencies of the May 29th, 1919, total eclipse of the sun, showing the eclipsed sun and surrounding stars, corona, and great prominence; also photographs of the sun and sun spots, together with records of the magnetic disturbance of March 22nd-25th, 1920, and a diagram showing the variation of latitude from 1912 to 1919.

Finally, Dr. J. C. Mottram and Dr. E. A. Cockayne demonstrated the presence of fluorescence in *Lepidoptera* by means of ultra-violet radiation. The beam of ultra-violet rays was produced by a quartz mercury-vapour lamp in a box with a window made of glass invented by Prof. Wood, which is transparent to radiation of wave lengths lying between 3,900 and 3,100 A.U., but opaque to light. Only a small proportion of the *Lepidoptera* examined have proved to be fluorescent, the most brilliant being geometrid months of the genus *Ourapteryx* and allied genera.

A CLOUD-BELT OF SOLAR ELECTRONS.

(Note by *Epsilon*.)

The following letter from the Rev. Fr. A. L. Cortie Director of Stonyhurst College Observatory, recently appeared in the *Times*, and was reproduced in the *Tablet* of April 17th.

As a striking sequel and supplement to cognate matter presented in the Electrical Review of December 19th and 26th, 1919, also March 5th, 1920, Father Cortie's glowing and vivid description acquires additional point owing to the electronic interest attaching to his reference to clouds of electrified particles—with all the vistas his graphic picture thus opens out.

Notwithstanding the few weeks elapsed since these events happened, this matter is by no means obsolete, or out-of-date, especially as time has been utilised to obtain from ocean cable authorities some reply to Father Cortie's final query as to the practical effect of the March 22nd-23rd disturbance upon the working of ocean cables.

Surely enough, we hear from a leading authority responsible for the working of several ocean cables laid fairly due east-west, that on March 22nd-23rd, earth-currents were heavy—at times reaching 60 volts. Practically, however, effective working was maintained almost continuously, actual stoppages having been few, and of quite short duration.

Father Cortie's *Times* Letter.

The indisputable connection which exists between a disturbed state of the sun's surface, as evidenced by sun spots, and terrestrial magnetic storms, was strikingly exhibited in the great sun-spot group which crossed the sun's visible hemisphere, March 16th-29th, and the violent magnetic storm of March 22nd-23rd. The sun-spot group, which was easily visible to the naked eye, was the greatest that has appeared since August, 1917. It covered an area of about eight thousand millions of square miles, more than ten times the superficial area of the whole earth. When crossing the sun's central meridan it extended over 39 degrees of longitude, representing a total length of about 180,000 miles. It was six degrees below the sun's equator, almost in a line with the earth.

This same region of the sun had begun to be disturbed at the end of last December, and at the end of January a fine long train of spots had developed, extending over 25 degrees of longitude, and similar in appearance to the great group of March. In the intermediate rotation of February the region of disturbance was marked by a few small spots.

From this huge area of solar disturbance proceeded clouds of electrified particles, driven into space most likely by the pressure of the sun's light. Into this belt of invisible clouds the earth entered at a few minutes past 9 a.m. on March 22nd, and instantaneously the signal of the event was given to all the magnetic observatories over the world by a sharp to-and-fro movement of the needles. The end of the storm occurred at about 8.50 a.m. on March 23rd. The earth's orbital velocity is 18½ miles per second, and in the stated interval of time it would have travelled more than a million and a half miles,

which number furnishes some idea of the lengthwise dimensions of the cloud-belt through which it rushed.

Meanwhile the earth was turning on its axis, and during the daylight hours the force of the earth's magnetic field was increasing, and the direction needle was swinging westward, while the opposite conditions obtained during the night hours. Upon this general movement of the needles many rapid and violent oscillations were superposed, especially between 16 and 20 hours on March 22nd, and between midnight and 4 hours on March 23rd. To give some idea of the violence of the storm, the spots of light, reflected from the mirrors attached to the delicately suspended needles, went quite beyond the limits of registration on either side of the drums carrying the photographic sheets. This means that the total range in force was at least forty times what it had been on magnetically normal days during January and February. The direction needle experienced swings of 90, 120, and 130 minutes of arc W. and E. during short intervals of time. The total range of this needle was 160 minutes of arc—that is, the compass at Stonyhurst would at times have given directions more than a degree from the true position. During this storm the swing of the needle was increased thirty-two-fold its deviations during the past two months. The supposed reception of extra-terrestial signals on the wireless apparatus of several stations, as recently announced, pales into insignificance beside such movements of the needles, controlled from a distance of nearly 93 millions of miles. The wireless signals could probably be traced to a similar solar origin. The end of the storm was marked by a rapid quivering of the needles, which was continuous during the last four hours.

The visible evidence of the passage of the earth through the cloud-belt of particles was furnished by a fine display of the Aurora Borealis. As seen by Lieut.-Col. Penny, R.A.M.C., the commanding officer of Queen Mary's Military Hospital, Whalley, in our immediate neighbourhood, it consisted of broad beams of flickering light which reached nearly to the zenith. Across these beams, near their summits, lay an oblique band of light, waning and waxing in intensity. In colour the display was mostly white, with a red tinge in parts. It lay almost symmetrically about the magnetic meridian.

It will be interesting to learn whether the earth-currents, which at times interfere seriously with the transmission of telegraphic messages, with cable-laying operations, and even with the running of the tramways, were experienced in any force on this occasion.

LEGAL.

The Importance of Registering under the Business Names Act.

In the Shoreditch County Court, on May 11th, before Judge Cluer, the Electrical Repair & Manufacturing Co., of 187, Goswell Road, E.C., electrical engineers, sued Hettie Anders, of 35, Darenth Road, Stamford Hill, as administratrix of the estate of Nat Anders, to recover £7 12s. 6d. When the case was called on Judge Cluer asked if the firm were registered under the Business Names Act, and ascertained that through ignorance they were not. His Honour then said he could not hear the case, as a firm could not sue under a contract unless they were registered under the Business Names Act. Their solicitor, Mr. Whitton, would tell them how to get relief if it had not been wilful. Plaintiffs' Representative: It has not been wilful. Judge Cluer: Well, he will tell you, but I cannot hear the case now; it is dismissed.

Indian Water Power.—The February issue of *Indian Industries and Power* gives a brief history of hydroelectric developments in India. It is stated that the Municipality of Darjeeling was the first authority to take advantage of this cheap form of motive power by the installation, in 1897, of two separate plants operating in parallel under heads of 275 and 650 ft. The Cauvery Falls, which is now one of the principal sources of hydroelectricity in the country, was first exploited in 1902, when the power was transmitted a distance of 92 miles to the Kolar (Mysore) goldfields. In 1903 the Government erected a plant for the production of energy for a cordite factory at Karteri Falls, Madras, obtaining an effective head of 624 ft. From the rapids of the Jhelum river power was obtained, in 1909, for dredging the river, by means of a timber flume 6½ miles long. There were several small developments up to 1914, when the Tata Hydroelectric Power Supply Co. made its first large installation at Khopoli. Obtaining an effective head of 1,725 ft., maintained during the dry season by means of extensive reservoirs filled during monsoon periods, a total development of 67,000 H.P. was made. The energy was transmitted, at a pressure of 100,000 volts, a distance of 43 miles. The Tata Co. owns the largest hydroelectric plants in India, the Andhra Valley installation, which is the largest mentioned in the article, possessing a total development of 68,000 H.P.

ELECTRICAL HAPPENINGS OF INTEREST.

[Nowadays the lay Press is not slow to cater for an enlightened public which appreciates technical news—especially if it relates to the latest wonder-invention. It behoves us to move with the times.]

(From our Codford Representative.)

A strange accident took place on Wednesday afternoon. It appears that P.C. Eyesharp noticed a young man perched on the roof of a tramcar, and apparently tampering with the overhead wire. He shouted a warning, and this so startled the young man that he overbalanced, and, narrowly missing a fatal shock from the wire, fell to the ground.

I called at the hospital later, and gathered from the young fellow that he is a student at the local technical college, and had been testing a certain law of Umpire, a well-known scientist of the 17th century. Armed with a compass, he had, prior to the disastrous experiment on the tramcar, already derived great practical benefit from tracing our electric mains.

He pointed out that the magnetetic energy of the tramway and other wires is sheer waste. With commendable zeal, he has already begun a revolutionary article on "Our Wasteful Electric Systems."

(By Private Wireless from Sparkeville.)

A distressing fatality occurred on Monday in the presence of a number of well-known electrical experts. The latter were investigating the claims of a local man known as "The Voltage Diviner." This worthy had found that high-tension currents did not harm him, and that he could actually calibrate himself. The Meteorological Office having announced the imminence of a thunderstorm, a demonstration before a number of experts was arranged. The Voltage Diviner was to conclude by measuring the electric pressure of a lightning flash.

After a series of startling tests on low and high voltages, and briefly finding the strength and direction of passing wireless waves, the Diviner connected himself to a lightning conductor. When the flash occurred, the assembled experts eagerly leaned forward to hear the verdict. At the inquest the Coroner touchingly commented on the fearlessness which characterises modern investigators.

In the course of his duty in Muggleton High Street, yesterday, a constable's suspicions were aroused by the arrival of a fierce-looking man with a portable electric generating set. This the man proceeded to set up on the pavement. He then placed a sheet of metal on one of the steps of No. 73 and ran a wire from it to the engine, which he started-up.

Upon the constable questioning him, he replied that he was going to take a film. The constable was satisfied, but remained nearby in the hope that he might appear on the film. Shortly afterwards the door of No. 73 opened, and a gentleman descended the steps. After a loud ejaculation of rage, the man with the engine collapsed in a fit. He was then given into custody.

It seems that the gentleman had recently dismissed the man from his employment, and the latter had, with fiendish cunning, planned to electrocute his former employer. Fortunately, the miscreant had been unaware that one of the intended victim's legs is of wood—this, of course, refusing to carry the deadly current.

Our Ketchem Correspondent writes:—During the week a number of trials with a startling new invention have been carried out here. The innovation takes the form of an original type of electric vehicle which will run at an efficiency of no less than 180 per cent. I have succeeded in gleaning a few details from the inventor. Naturally, he was a little reticent—the many patents which cover his invention not having yet been granted owing, as he tersely explained, "to the inertia of those red-tape Patent Office officials."

The car is similar to the ordinary light car, but no bonnet or wheels are visible. All the energy (electric) is generated under one of the seats, and the "magnetic repulsor" (which only weighs 10 lb, and yet develops up to 40 H.P.) is mounted at the car's centre of gravity, and by its effect on the earth currents can give speeds up to 140 M.P.H. Wireless switches are used for the various controls. As regards the source of current, the inventor would say nothing further than that he had "collared the electrons, and practically solved perpetual motion."

The inventor asserts with justifiable pride that his car will revolutionise the transport industry. As I left, the Screenit Co. was filming the modest inventor and his wonderful machine.

British Trade with Italy.—Mr. F. G. Kellaway, M.P., Parliamentary Secretary to the Department of Overseas Trade, is paying an official visit to the British Chamber of Commerce in Italy. He will be accompanied by Sir Frederick Butler, K.C.M.G., C.B., and Mr. T. D. Dunlop of that Department. He will attend the annual dinner of the British Chamber of Commerce for Italy at Genoa, on May 15th, and will afterwards proceed to Rome, Milan, and Turin to study on the spot questions affecting British trade with Italy, and to inspect the work and equipment of His Majesty's commercial, diplomatic, and consular services in Italy.—*Financial Times.*

BUSINESS NOTES.

"Coming of Age."—Congratulations to the firm of MANN, EGERTON & CO., LTD., of Norwich, on its "Coming of Age." The business was founded in April, 1899, by the present chairman and managing director. Amongst the 1,200 employés of the company, over 50 have served the firm for periods exceeding 10 years; over 20 for periods exceeding 15 years; whilst four have served 21 years.

Football.—The Hartonians Athletic Football Club, which consists of the employés of the HART ACCUMULATOR CO., LTD., of Stratford, London, has just concluded a most successful football season, having won the Eastern Suburban League (Div. 2, Sec. A) Shield and Medals with the following record :—

Played.	Won.	Drawn.	Lost.	For.	Against.	Points.
20	16	1	3	58	18	33

Four friendly matches were also played, three of which were won, and the remaining game drawn, with a goal record of 18 "for" and two "against." The team has been well led by the captain (J. Smith), whose play at centre forward has been marked throughout the season with splendid consistency, he himself having scored on 32 occasions. Other good records were F. Drew, who scored 20 goals, and R. Killick, who netted on nine occasions. F. Drew has been a hardworking and painstaking hon. secretary, and he was also a capable inside left forward.

Aircraft Disposal.—THE AIRCRAFT DISPOSAL CO., LTD., who recently took over the whole of the surplus stock of aircraft material from H.M. Government, state that their sales department is now established at Regent House, Kingsway, London, W.C. 2, for the purpose of dealing with inquiries and orders for this stock, and from time to time offers for the disposal of the various materials will be circulated. Those interested in any particular class of material should communicate immediately, when special attention will be given to their requirements. With regard to aeroplanes and engines, it is the intention of the company to maintain a fixed price list, quoting definite prices from which a rebate will be quoted to all British aircraft manufacturers, British merchants, and firms dealing in aircraft accessories and components.

Standards in Sweden.—The Swedish Electrical Standardising Committee has issued a proposal for the adoption of the Edison screw for lampholders and sockets. It is based upon the standard adopted in France. Hitherto German standards have been exclusively used in Sweden.

Graphite Electrode Production in Norway.—The directors of the Norske Elektrodeverker A.S., of Christiania, in the course of an invitation for subscriptions to an issue of preference shares, so as to provide the means for extending the number of producing furnaces, state that the company has succeeded in turning out graphite electrodes which are equal to the best American products, and the first electrodes made have been tested with very satisfactory results at a thermo-electric installation. The prospects of business are considered to be very favourable, as besides Scandinavia, the company will have a big market in practically the whole of Europe. In particular the English market, the directors remark, is open for a quantity greater than the company's present production, and on the investigation which the board recently made in England, "it was shown that a Norwegian product will be received with great goodwill."

New Engineering Union.—The new Amalgamated Engineering Union, embracing the A.S.E. and 10 other societies connected with the engineering trades, will be formally constituted on July 1st. Its membership will not be far short of 500,000, and the funds are estimated at nearly £4,000,000. The programme of the new Union is not yet complete, but its first energies will be devoted to increasing wages. The present proposal is that the Union should demand a minimum for skilled engineers of £6 10s. per week. The present average weekly wage of the members is asserted to be between £4 10s. and £5 10s.—*The Times.*

The B.E.D.A.—Among the latest publications of the British Electrical Development Association is a booklet detailing the aims and objects of the society. A list is given of the members of the council and executive committee, and the methods of publicity are fully described, examples of B.E.D.A.'s pamphlets being illustrated. A report of activities is included, setting out the various ways in which public attention has been attracted to the benefits of "doing it electrically." At the end of the booklet a form of application for full particulars of the scheme is inserted. We have also received a reprint of an article entitled "Housing Construction and Electricity Supply," which, originally published by *The World's Work*, is being circulated by the Association.

The Employment of Demobilised Men.—The Rotary Club is trying to place in employment the thousands of demobbed men unable to find work. They are unearthing some valuable men, and employers needing labour could not do better than send particulars to the "Jobs for Demobbed Committee," "Rotary Room," Horrex's Hotel, Norfolk Street, Strand, W.C. 2.

Plant for Disposal.—York City Electricity Department invites offers for two 360-H.P. Willans high-speed engines direct-coupled to 460-500-volt Crompton generators, and two 50-H.P. 460-volt E.C.C. motors. For particulars see this issue.

"Safety First."—The pioneer of the "Safety First" movement, which has gained so much ground and had such excellent results in the U.S.A., the National Safety Council has sent us a booklet dealing with its formation, methods of publicity, &c. It is illustrated by reproductions of a few of the many posters published by the Council, which are very compelling, and of definite local interest. The Society claims a great reduction of accidents to workpeople as the result of its propaganda, and, from the figures given, this would seem to be amply justified. We have also received a copy of the "National Safety News," published weekly by the organisation, as well as an application form for membership. It is of interest to note that the British Government has applied for 23 memberships of the Council for the Chief Inspectors of Mines and Factories and for Superintending Inspectors of Factories in London, Manchester, Birmingham, Glasgow, Leeds, and elsewhere.

The E.P.E.A. and the E.T.U. at Port Sunlight.—The strike of Electrical Trades Union men at Messrs. Lever Bros'. works at Port Sunlight, owing to the employment of men in the Electrical Power Engineers' Association, has resulted in a temporary agreement being reached between the two organisations, the terms of which are as follows :—

A. That the E.P.E.A. circular dated February 24th, 1919, be publicly withdrawn through the ELECTRICAL REVIEW.

B. That the question of the *bona fides* of the E.P.E.A. as a recognised Trade Union be temporarily dealt with by the Liverpool or Birkenhead Trades Council whose decision shall be without prejudice to any final proceedings before, and shall not be submitted as evidence to, the Trade Union Congress.

C. As an alternative to Clause B the E.T.U. suggest a temporary working agreement to be restricted to Lever's on the following lines :—That the members of the E.P.E.A. employed at Lever Bros. shall in all matters connected with the firm, act in conformity in every way with the decisions of the Electrical Trades Union, Mersey District Committee, pending a joint meeting of the two executives on May 28th, 1920.

D. That where under Clause C matters affecting the position of the members of the E.P.E.A. are to be considered by the Mersey District Committee of the Electrical Trades Union, three representatives of the E.P.E.A. shall be co-opted on such Committee with full voting powers.

E. That in any case where members of the Electrical Trades Union are in dispute at Messrs. Lever Bros., members of the E.P.E.A. undertake not to do anything calculated to defeat the objects of such dispute. Further, that the E.P.E.A. are prepared to convey this in writing to Lever Bros.

The foregoing shall be a temporary agreement, and shall be valid pending the meeting of the two executives, and shall be without prejudice to the position of either one society or the other.

The E.P.E.A. representatives indicated that they preferred to adopt Clauses C and D, instead of Clause B.

Both parties agreed to recommend these proposals to their members for acceptance.

Book Notices.—Scientific Paper No. 371 of the U.S. Bureau of Standards, "A New Cadmium-Vapour Arc Lamp" (6 pp.). Washington : Government Printing Office. Price 5 cents.—This paper deals with a new method of producing a cadmium vapour arc of great brilliancy. Since gallium has a boiling point above 1,500° C., the vapour pressure relation existing between cadmium and mercury is reversed when compared with cadmium and gallium. The cadmium, therefore, acts as the energy carrier when used in combination with gallium in a quartz lamp.

"*Journal* of the Institution of Electrical Engineers." Vol. LVIII, No. 290. April, 1920. London : E. & F. N. Spon, Ltd. Price 10s. 6d.—This issue contains the following paper :—"Eddy Currents in Stator Windings"; also, the annual accounts for 1919, and the Report of the Council for 1919-20.

"*Proceedings* of the Physical Society of London." Vol. XXXII, Part 3 (73 pp.). London : Fleetway Press. 4s. net.—Includes papers on "Testing Magnet Steel," by N. W. McLachlan, D.Sc. (Eng.), and "Forces on Heated Metal Strips," by Gilbert D. West, M.Sc. (Lond.).

"Woodland Notes." (39 pp.).—This well-produced and illustrated magazine is described as "a brief account of Fuller's United Electric Works, Ltd. The social activities of the employés, those they work with, where they work, and what they make," and the object is very well accomplished in this publication, which may be obtained by any member of the electrical industry from Messrs. Fuller's.

"Rotary Converters : Their Design, Construction and Use." By C. Sylvester. Pp. 59; 26 figs. London : S. Rentell & Co., Ltd. Price 2s. net.

"Electric Oscillations and Electric Waves." By G. W. Pierce. Pp. ix + 517; figs. 133. London : Hill Publishing Co., Ltd. Price 30s. net.

"Year Book of Wireless Telegraphy and Telephony, 1920." London : Wireless Press, Ltd. Price 10s. 6d. net.

The issue of *Conquest* for May contains an article by K. Robertson on "Power from Waste," explaining how the waste gases from blast furnaces are used for generating electricity, in addition to heating the blast. Prof. Sir Chunder Bose's remarkable work on plant life, and his magnetic crescograph, are described by K. K. Chatterjee, and there is a variety of extremely interesting articles on other subjects related to science.

Brazil. — Steel Works and Electrification in Minas Geraes.—A telegram from Rio de Janeiro dated April 27th, received by the *Times* through the *Agencia Americana*, states that the terms of the contract between the Government and the Itabira Iron Ore Co. have been published. They provide for the construction of high power coke furnaces for the production of steel with a guaranteed minimum production of 150,000 tons of steel sheets, ingots, &c. This telegram is of particular interest when read in connection with the report which has been made by the American Commercial Attache at Rio de Janeiro of the arrival in Brazil at the beginning of the year of representatives of a syndicate to reorganise and electrify the Victoria Minas Railway from the port of Victoria, State of Espirito Santo, to the mineral section of the State of Minas Geraes. The State of Minas Geraes has always contended that its immense iron deposits should be utilised to the fullest advantage of the State, and therefore has maintained a somewhat indifferent attitude toward any proposals regarding the exportation of iron and manganese ores. In fact, one of the greatest handicaps to the exportation of the latter has been the heavy taxes imposed by the State; the inadequacy of transportation facilities has likewise been a drawback. It is understood that the syndicate proposes first to extend its railway to the mineral region, to install works for reducing sufficient ore to meet the iron and steel requirements of the country, and to develop the mines and transportation facilities to permit the exportation of ore in large quantities. Steamers carrying the ore will return loaded with coke and combustibles for the local mills, as it is evidently the opinion of the syndicate's engineers that domestic coal cannot be used because of the large percentage of ash—over 30 per cent. Electrical furnaces, too, though used to some extent in converting iron to steel, have not been found economical for the reduction of ore to iron. One of the problems involved in this study of the exportation of Minas Geraes ore is the distance of the deposit from the coast, some 550 kilometres (342 miles); whereas deposits found in Spain, Sweden, or northern Africa, whence British supplies are at present taken, are only 180 to 200 kilometres distant. In order to overcome this difference the syndicate intends to improve the Victoria Minas Railway by reducing the grades and lessening the curves. A second problem, that of obtaining return freight for the ore shipped, might well be solved by bringing back coke and fuel for the national industries. One of the technical directors engaged to install the proposed steel plant recently arrived on the ground for studying the problem with a view to selecting the best site for the plant.

Association of German Industries.—The German Press has paid considerable attention of late to the formation of the above association, particulars of which are forwarded to the Department of Overseas Trade by the British Commercial Commissioner in Cologne. The association was formed in 1919, and has as its purpose the representation and development of the German industries and the determination of uniform policy of each separate trade and common action in dealing with labour questions. The association has a council and directorate, the latter consisting of at least 30 and not more than 60 members, who either occupy or have occupied a leading position in an industrial undertaking, or have held a position on a board of directorate. The council is empowered to nominate a further 10 members to the directorate. The council, consisting of 7 to 15 members, is elected from the members of the directorate. The chairman of the council is Dr. Ingenieur Kurt Sorge, Berlin; first representative of the chairman is Abraham Frowein, Elberfeld; second representative of the chairman is C. F. v. Siemens, Berlin-Siemensstadt; managing director, Privy-Councillor Dr. W. Simons. A Main Committee is nominated, states the *Deutsche Bergwerks Zeitung*, and consists of representatives of each of the 25 industrial branches into which the association is graded. The total number of representatives is 140, distributed as follows:—

Mining 15, iron producing 10, metal works and metal semi-products 3, machines 8, railway wagons 2, hardware 4, iron and steel goods 5, electro-technical precision instruments and optics 3, boilers and fittings 2, automobile and bicycles 3, timber 5, leather and leather manufactures 4, stone and earth 6, building 3, pottery 3, glass 4, chemical 10, oils and fats 3, paper 8, textiles 23, clothing 3, breweries and flour and malt mills 3, sugar and foodstuffs 4, provisions 3, shipping and transport 3.

In addition to the 140 members of the industrial groups the Main Committee is further composed of 10 representatives of agricultural associations, 10 representatives of home industries elected by members meeting at the suggestion of the directorate, and 10 representatives of members of the association nominated at the suggestion of the directorate. The Main Committee nominates special committees, and elects from year to year a Committee of Investigation. The following special committees have been formed:—

(1) Committee for the carrying out of the Articles of the Treaty of Peace.
(2) Tax Committee.
(3) Economic Committee.
(4) Social-political Committee.
(5) Press Committee.
(6) Committee of Investigation.

Mutual Discussion.—For the first time since its inauguration in 1916, the National Alliance of Employers and Employed is holding its annual meeting in the provinces. Hitherto, members of the Alliance have met in London, but this year it was decided that, in view of the important Joint Committees of employers and Trade Unionists which the organisation has established in many important provincial centres, the Annual Conference should take place on June 1st in a great industrial area. For this reason, Birmingham, the headquarters of the West Midland Federation of the National Alliance, has been chosen. Extremists in Labour ranks, reactionaries among employers, believe in the policy of force. The Alliance stands for forbearance, and the work it has accomplished is an assurance that steadily increasing numbers of employers on one side, and representatives of organised Labour on the other, are massing themselves with this movement, and striving for agreement over industrial problems—with goodwill. The National Alliance takes a grave view of the present spirit of unrest manifested in every section of the community. The price of commodities still increases, and with every rise in wages there is a corresponding increase in the cost of living. Labour blames Capital, and Capital blames Labour, but there is no whole-hearted effort on the part of either side to grapple with the problem in that spirit of unity which won us the war. The National Alliance claims to be the only organisation which can provide the machinery for a round table conference of employers and employed *of all trades*, who can discuss dispassionately the vital problems which touch intimately their very lives, and strike at the root of the trouble. In the great industrial centres where Alliance Committees are established, problems such as housing have been profitably discussed by local employers and Trade Unionists, and at such discussions the barriers of mutual suspicion and recrimination between Capital and Labour have been broken down.

Trade Announcements.—The Benjamin Electric, Ltd., of Tottenham, have been appointed sole selling agents by the Moto-Meter Co., Inc., for the Boyce Moto-Meter device, intended for use on motor cars, which indicates the temperature of the water in the radiator, thus notifying the driver of any undue overheating 15-20 minutes before he would otherwise be aware of the fact by engine trouble.

Mr. J. Harrison announces that he is continuing the business of Messrs. Harrison & Wylde, electrical engineers, of Rotherham, under the style of Harrison & Co.

The Jackson Electric Stove Co., Ltd., are removing to 143, Sloane Street, London, S.W.

In order to cope with the increased business of their Cardiff branch, the British Thomson-Houston Co. have acquired, and now occupy, much larger premises at 7, Park Place, Cardiff, a few doors from the old address. Telephone number as before:—"Cardiff 4392." At the new office considerably larger stocks will be held, especially of the company's many forms of lighting appliances.

Catalogues and Lists.—The Delta Electrical Co., Temple Courts, Temple Row, Birmingham.—Pamphlet No. 100, illustrating and describing a new patent dolly-operated watertight tumbler switch.

Building Products, Ltd., Columbia House, 44-46, King's Road, Sloane Square, S.W. 3. A leaflet illustrating the "Benquic" bar-bending machine for steel rod of any section, up to 1¼ in. diameter circular.

Automatic and Electric Furnaces, Ltd., 281-283, Gray's Inn Road, W.C. 1.—"Heat Treatment Bulletin" No. 21, describing the construction and advantages of Wild-Barfield patent electric furnaces. Includes a photograph of a typical radiation furnace installation.

Messrs. Siemens Bros. & Co., Ltd., Palace Place Mansions, Kensington Court, W. 8.—Pamphlet S 535 (15 pp.) giving a fully illustrated description of "Autophone" No. 2 automatic telephone system. The major portion of the pamphlet is devoted to a description of the ingenious switching apparatus and photographs of the component parts.

Messrs. Brookes, Ltd., Lightcliffe Works, Halifax.—"Science, War and Commerce" (36 pp.), a booklet describing the firm's war-time activities; and "Dreams and Realities" (16 pp.), transcription of an interview with the managing director.

Messrs. Imeson & Finch, Empress Works, Stockton-on-Tees.—A 12-page catalogue, illustrating and describing controllers, armature coils, brush-holders, trolley heads and wheels, commutators, fuse-holders, &c.

Italian Companies.—There has been formed in Milan a company styled Officine Elettromeccaniche Monteggia, with a capital of 1,600,000 lire.

At Montaldo has been launched the concern Segheria di Montaldo Dora, with a capital of 180,000 lire, for the dual purpose of sawmilling and the production and distribution of electrical energy.

The Società Anonima Radiotelegrafica Italiana has been established at Milan (Via Cavallotti 3), with a capital of 2,000,000 lire, for the manufacture of wireless telegraphic and telephonic apparatus.

With headquarters at Milan (Via Carlo Alberto 4) Zanni e Pirini have been incorporated as a company, with a capital of 150,000 lire, to conduct an electro-galvanoplastic laboratory.

Allocchio, Bacchini e Ca. have been formed into a company at Milan (Via Rasori 14), with a capital of 400,000 lire, for the manufacture of electrical measuring apparatus.

Electrical Wages at Liverpool.—The Mersey District Committee have given three months' advance notice of an application for an advance in wages from 2s. 1½d. per hour to 2s. 6d. per hour for all electricians employed in the Liverpool area. Application is also being made for a 10s. advance for youths over 18 years, and 5s. a week for those under.

Bankruptcy Proceedings.—Albert Edward Channon, Humphrey Stanton Nadin, and Cyril George Channon (trading as A. E. Channon & Co.), electrical engineers, 8, Orrisdale Terrace, and 425, High Street, Cheltenham, Gloucestershire.—In this matter the receiving order was made on April 26th, 1920, on the debtors' petition. The liabilities in the partnership statement of affairs amount to £1,363, and the assets to £387. The separate liabilities of Albert Edward Channon amount to £22, and assets £25, thus showing a surplus of his separate estate of £3. The liabilities of the debtor Nadin amount to £8 15s. 6d., and he has no assets. The separate statement of C. G. Channon show liabilities amounting to £4 10s. 6d., and he also has no assets. The causes of failure alleged by the debtors are want of capital, losses on contracts, pressure by creditors, and ill-health of A. E. and C. G. Channon. The debtors were adjudged bankrupt on the same date as the receiving order was made. An execution was levied on February 8th last, and the debt and costs, amounting to £97, were paid. Two creditors have issued writs for sums amounting to £103, and there are several small judgments outstanding. The debtors, who are father, son-in-law, and son, state that they commenced business as electrical engineers at 425, High Street, Cheltenham, on January 1st, 1912. Their joint capital did not exceed £10, but stock-in-trade to the value of £200 was then obtained on credit. The books of account kept were sold ledger, day, invoice, order, and estimate books. The debtors further state that they took stock in February last, and, according to a statement given to one of the creditors, at that time they valued the assets at £647, and estimated the liabilities at £613. Having regard to the debts now scheduled in the statement of affairs, it would appear that the liabilities must have been greatly under-estimated. The debtors state that they became aware of their position in February last, and they have since contracted debts in the expectation of being able to retrieve their position. The unsecured liabilities on the separate estates of the debtors are for domestic debts. The following are creditors :—

Baxendale & Co.	£94	Metallic Electric Co., Ltd. ..	£12
Braulik, G.	44	Olivant	39
Bill & Berry	25	Simplex Conduits, Ltd.	45
Callender's Cable Co., Ltd. ..	25	Simpson, Baker & Co.	118
Drake & Gorham, Ltd.	123	Sharp, Fisher, Ltd.	502
Elco Manufacturing Co. (Bristol)	54	Fisher, John, & Sons	12
Export Loose Letter Sign Co. ..	11	Separate estate of A. E. Channon:	
Ediswan Co., Ltd.	58	The Cheltenham and Gloucester	
Falk, Stadelmann & Co., Ltd. ..	42	Building Society, Cheltenham	
Henley's, W. T., Ltd.	48	(Sec. £350)	320

The first meeting of creditors herein was fixed to be held on May 14th at the County Court Buildings, Cheltenham, but no creditors attended. The Official Receiver stated that he had received several proxies, one of which was a special proxy for £55, with directions that he should continue as trustee. There were, however, he stated, two points which would require investigation. One was in respect of the removal, by one of the largest creditors of goods, to the value of about £200, on 16th and 17th ult., and application had already been made for their return. The other point was with reference to the house and furniture. The affairs will remain in the hands of the Official Receiver.

Lewsley, J. W., electrician, lately trading at 103, Mansfield Road, Nottingham.—June 5th is the last day for the receipt of proofs for dividend. Trustee, Mr. E. W. Humphreys, 4 Castle Place, Park Street, Nottingham.

G. F. Kiveron, electrical engineer, Sheffield.—First meeting, May 21st; public examination, June 10th; both at Sheffield.

Quain Electric Co., Ltd.—In the Companies Winding-Up Court on Tuesday, the petition of R. & A. Main, Ltd., of Gothic Works, Edmonton, for a compulsory order to wind-up Quain Electric Co., Ltd., came before Mr. Justice Astbury. Mr. Jolly, for the petitioners, said the petition had stood over for a fortnight in view of negotiations for a compromise. The only parties opposing the petition were the debenture-holders, and Mr. Bennett, who appeared for them, had agreed with him that the petition should be withdrawn without any order as to costs. Mr. Bennett: I agree. His Lordship allowed the petition to be withdrawn, without costs.

Capital Expansion of the German Siemens Co.—As a result of the great advance in the prices for raw materials and in wages, together with the reduction in the working shift, and the decreased efficiency of the workmen which have prolonged the time of manufacturing as compared with former years, the directors of the A.G. Siemens & Halske, of Berlin, have prepared a scheme for doubling the spare capital and making alterations in the company's statutes so as to prevent foreign interests from acquiring control over the undertaking. It is proposed to increase the present share capital of 63 millions of marks to 126 millions by the issue of new bearer shares for 63 millions, which are to be offered to existing shareholders at the price of 125 per cent., and to be entitled to participate in the dividend for 1920 for one-half of the year, and one new share can be subscribed for each existing share. It is recognised in Germany that the influence and co-operation of the Siemens family in connection with the company have answered the purpose during the course of decades, and it is now intended to convert a large number of the old shares into preference shares, with a manifold right of voting, namely, each preference share will be endowed with 30 votes. It is assumed that the raising of further capital in the future, and, if necessary, of obtaining capital from abroad will be facilitated in this way without losing the existing control and the German character of the undertaking. Thus, the ordinary shares ranging from No. 1 to 9,500, now held by the Siemens family, and representing a nominal amount of 9,500,000 marks, will be transformed into registered preference shares, and with the manifold voting power mentioned will be equal to 285 millions of marks.

The special voting power conferred upon the preference shares is only to be exercised in the case of decisions of vital importance, as, for instance, alterations in the company's statutes increases or decreases in the share capital, changes in the object of the undertaking, amalgamation or dissolution of the company, elections to the board of directors, and voting in regard to the dividends. On the other hand, limitations are to be imposed on the transfer of the preference shares. For instance, the transfer of shares to other persons is made dependent upon the sanction of the president of the Berlin Chamber of Commerce, and can only be granted if the prospective purchaser gives a guarantee that he will protect the rights of the company as German, and if he is a German residing permanently in Germany or in German Austria. It is also intended to modify the statutes so that the majority of the directors must be Germans. The directors believe that the scheme, without materially prejudicing the rights of the ordinary shareholders, will prevent the company from passing under foreign control. As bearing on this point it is mentioned that frequent inquiries from abroad have already been made for ordinary shares in the company. If the directors may think of taking advantage of those offers for the future financing of the company, they at the same time have considered it necessary already now to adopt the measures referred to, in order to obviate undesirable consequences.

It is assumed that a considerable portion of the proposed new capital is intended for the Siemens-Schuckert Works, either by way of an increased loan or additional ordinary capital. If this assumption should prove to be correct, there is no doubt that the other joint partner in the Siemens-Schuckert Works—the Schuckert Co., of Nuremberg—will have to undertake a new financial transaction if the respective capital investments in the Siemens-Schuckert Works are to remain on an equality.

The F.B.I. Abroad.—We have received a summary of the report prepared by Sir Charles Mandleberg on one year's achievements of the Federation of British Industries Commissioner Service. The following is a list of Commissioners and Representatives abroad :—

Place.	Name and address.	Status.
Near East ..	Major E. Kennard, Athens	Commissioner.
Greece	Capt. R. C. Cumberbatch, Athens ..	Sub-Commissioner.
Turkey ..	Capt. Lafontaine, Athens (temporarily)	Sub-Commissioner.
East Indies ..	Mr. G. O. Blacker, Singapore	Commissioner.
Spain	Col. C. Thoroton, C.M.G., Madrid ..	Commissioner.
Algiers	Mr. D. Thoroton, Algiers	Sub-Commissioner.
Brazil	Mr. P. J. McKellen, Rio de Janeiro ..	Commissioner.
Scandinavia ..	Mr. Montagu Villiers, Copenhagen ..	Commissioner.
Denmark ..	Mr. Paul Christensen, Copenhagen ..	Correspondent.
Australia ..	Mr. R. H. Butler, Melbourne	Correspondent.
Italy	Mr. E. H. Kapp, Milan	Representative.
Holland ..	Anglo-Dutch Committee, Amsterdam ..	Committee.
Canada	(1) Canadian Manufacturers' Association, Toronto.	Correspondents.
	(2) Canadian Association of British Manufacturers and their Representatives, Toronto.	Correspondents.
New Zealand..	New Zealand Association of British Manufacturers and their Agents, Wellington.	Correspondents.

In addition to the foregoing, representation of a temporary nature was arranged during the period under review in Portugal and in the Occupied Area of Germany.

Arrangements have also been made for honorary Correspondents in the following countries :—Denmark, Finland, U.S., Cuba, Mexico, Egypt, France, China.

Applications for British Trade-Marks.—Appended is a summary of the recent applications for British trade-marks in respect of goods connected with the electrical industries and trades :—

Atmos. No. 393,544. Class 8. Electric lamps and galvanometers. No. 393,545. Class 13. Electric bells and fittings. No. 393,546. Class 18. Lighting contrivances and electric bell systems.—General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C. July 23rd, 1919.

Solanti. No. 400,762. Class 39. Goods manufactured from india-rubber and gutta-percha.—India-rubber, Gutta-percha and Telegraph Works, Ltd., 106, Cannon Street, London, E.C.

Triangle (design). No. 399,244. Class 8. Resistance rods, coils, contact blocks and bearings, all parts of electrical apparatus.—The Morgan Crucible Co., Ltd., Church Road, Battersea, S.W. January 7th, 1920.

P.N. (design). No. 400,524. Class 13. Electric lamps.—The Pyle National Co., 1534, Kostner Avenue, Chicago. February 2nd, 1920.

Isco. No. 400,650. Class 13. Electric fittings.—W. T. Henley's Telegraph Works, Ltd., 13-14, Blomfield Street, London, E.C. February 11th, 1920.

Busy Bee. No. 396,862. Class 6. Electric motors and dynamos.—W. J. Allen & Wallace D. Vick, 73½, Coleshill Street, Birmingham. November 5th, 1919.

Bi-Spineflex. No. 401,312. Class 16. Electric insulators made of porcelain.—Taylor, Tunnicliff & Co., Ltd., Eastwood Works, Hanley. February 28th, 1920.

Majestic. No. 401,673. Class 13. Metal filament lamps, being ordinary electric lamps.—General Engineering Co. (Salford), Ltd., 74, Broad Street, Pendleton, Manchester. March 10th, 1920.

Morite. No. 400,239. Class 50. Electric insulators made of one of the phenol formaldehyde condensation products or syntheses of same.—Arthur S. Gush, 5, Clifton Terrace, Edinburgh. January 30th, 1920.

Blackcap-Ediswan (lettering combined with design). No. 400,154. Class 8. Electric lamps for philosophical purposes.—Edison Swan Electrical Co., Ltd., 123-5, Queen Victoria Street, London, E.C. January 29th, 1920.

Kalecore. No. 400,948. Class 8. Paper-insulated electric cables.—Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C. February 19th, 1920.

French Company Notes.—Under the title of Le Téléphone Moderne, Société d'Installations Téléphoniques, a company has been formed at Paris (12, Rue du Port Mahon), with a capital of 150,000 fr., for the installation of telephones.

The Société Générale de Force et Lumière have raised their capital from 30,000,000 to 50,000,000 fr. Eventual increase to 75,000,000 fr. is also authorised.

The capital of Le Fil Dynamo is to be raised from 500,000 to 3,000,000 fr., for the building of a new works.

The Société Hydroélectrique du Verdon has raised its capital from 1,000,000 to 2,500,000 fr. in order to secure rights on falls on the upper Verdon River.

There has been formed at Paris (Rue de Londres 29), the company Lignes Télégraphiques et Téléphoniques, with a capital of 10,000,000 fr., for the planning, manufacture and working of all kinds of electric lines and cables. This company is a trust of French cable and wire makers, embracing all the important firms except the Société Alsacienne, Jeumont, and the Société Industrielle des Téléphones. On its board of management are representatives of the Thomson-Houston, the Tréfileries et Laminoirs du Hâvre, the Canalisation Electrique, the Berthoud-Boret, and the Matériel Téléphonique companies.

The Electrodes de la Savoie is the style of a company launched at Paris (2, Rue Blanche), with a capital of 2,000,000 fr., for the manufacture of electrodes.

The Société Française de Lamps à Incandescence "Luxor" (Floret et Cie.) has been constituted at Levallois-Perret, Seine (8, Rue des Frères Herbert), with a capital of 375,000 fr., for the manufacture of glow lamps.

The Etablissements André Dauphin has been formed into a company (14, Rue St. Claude, Paris) for the manufacture and trade in electric material. Its capital is 100,000 fr. in 100 fr. shares, 100 of which are allotted to the Société Dauphin et Cie. for assets taken over.

Under the style of the Ateliers de Construction et Installations Electromécaniques has been formed at Rouen (52, Rue St. André), a company with 200,000 fr. capital, for the objects shown in its title.

The Compagnie Electro-Industrielle has been constituted at Levallois, Seine (Rue Jean Jaurès 32), with a capital of 3,000,000 fr., for the manufacture and trade in electrical material of all kinds, including metal working and mechanical.

The Etablissements Métallurgiques Rhône-Isère has been established at Lyons with a capital of 1,000,000 fr., for the objects set out in its title.

The Auxiliaire Industriel is the style of a company established at Paris (5, Rue d'Athènes), with a capital of 600,000 fr., for the study, manufacture, sale, and representation of all kinds of electrical material.

With a capital of 200,000 fr., Le Matériel has been constituted a company at Paris (21, Rue d'Edimbourg), for the trade in and manufacture of electrical material for public works, especially hydraulic, mechanical, and heating.

Under the title of Le Moteur Electrique has been formed at Lyons (18, Route de Crémieux), a company for the manufacture, purchase, and sale of motors, dynamos, and transformers; also their erection and repair. The capital is 1,000,000 fr.

Annual Outing.—No doubt there will be quite a marked revival of the annual outing this year, notwithstanding the high cost of everything. The first of the season, so far as reports have reached us, is that of the London branch of Messrs. Malcolm & Allan, Ltd., electrical engineers and contractors. A party of just over a hundred, including ladies, went to Maidenhead and district by the steam-launch *Empress of India*, on Saturday, May 15th. The company boarded the launch at Windsor. Luncheon was served on board. The sports events were very successful; football, three-legged and other races, occupied so much time and created such interest that there was not time for the cricket match. On the return to Windsor a successful concert and dance were held. The prizes for the sports were distributed by Mrs. H. S. Davidson.

The E.T.B.I.: Local Commitee at Newcastle.—A meeting for the purpose of appointing a local Advisory Committee of the Electrical Trades' Benevolent Institution for Newcastle and District, was held at the Mining Institute, Newcastle-on-Tyne, on May 10th. Mr. W. C. Mountain, who presided, briefly explained the objects of the Institution, and said that the Committee of Management was in London, but he thought they should have a Local Advisory Committee in the North-Eastern Area, which was very naturally, from the Tyne to the Tees. Mr. Mountain said it would not be very long before the present fictitiously prosperous times would come to an end. He did not want to be pessimistic, but there was no doubt that we were in for bad times before we were very much older, and if they were ready to help those who were unable to get employment, and who possibly might fall into bad luck and in a position where this Institution could help them, they would be promoting a very good object. Mr Hawes, the secretary, then outlined the work of the Institution, and gave typical examples of cases that had come before the Institution for aid. After a number of questions had been asked and answered, Mr. Clothier proposed; Mr. Anns seconded, and it was unanimously resolved, to elect a Committee for the district. Mr. Mountain is the chairman of the Committee; Mr. T. W. Anns, honorary secretary; Mr. J. Gledson, honorary treasurer; and the following are on the Committee:—Messrs. W. F. T. Pinkney, Newcastle Electric Supply Co.; D. Patterson, Newcastle and District Electric Lighting Co.; W. Dalton, Newcastle Corporation Tramways; J. W. Dodds, Electric and General Stores Co., Ltd.; Alan Robson, Simplex Conduits, Ltd.; H. P. Devereux, Devereux Moodie & Co.; R. Robson, Robson & Coleman; H. Barkes, British Electrical and Manufacturing Co.; J. Spence, General Electric Co., Ltd.; W. Fletcher, Fletcher Bros.; Mr. Clothier, Reyrolle & Co.; Mr. Stephens Holmes, Messrs. J. H. Holmes & Co.; Mr. Raw, Mining Electrical Engineers; Mr. Wyand, Sir W. G. Armstrong, Whitworth & Co.; Mr. Thompson, Cleveland and Durham Electric Power Co.; Mr. Sloan, Newcastle Electric Supply Co.; and one nominee from each of the following: Messrs. Clarke, Chapman & Co.; Messrs. Sunderland Forge and Engineering Co.; Society of Technical Engineers; Electrical Power Engineers' Association.

Liquidations and Dissolutions.—GRATZ, LTD.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. E. V. Hayes-Gratze, Elidia, Woodstock Avenue, Hendon, N.W. 4.

HYDRO-ELECTRIC CONCESSIONS, LTD.—Winding up voluntarily. Liquidator, Mr. W. Gain, 3 and 4, Great Winchester Street, E.C. Meeting of creditors at 3 and 4, Great Winchester Street, E.C., May 25th. Claims to be sent to the liquidator forthwith.

BRITISH EVER-READY CO., LTD.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. W. T. Walker, 53, New Broad Street, E.C. Meeting of creditors at Hercules Place, Holloway, May 25th.

BRITISH ELECTRICAL ACCESSORIES, LTD.—Meeting of creditors at 3, Cheapside, Bradford, May 21st.

ELECTRICAL AND MECHANICAL TRADES SUPPLY, Russell Buildings, St. Mary Street, Swansea.—Mr. W. A. Roderick and Mr. R. Scott have dissolved partnership. Mr. W. A. Roderick will attend to debts and continue the business.

ECONOMIC ELECTRIC CO., automobile and electrical engineers, 63, Knutsford Road, Warrington.—Messrs. B. Nadin, W. Wright and P. J. Dell have dissolved partnership. Debts will be attended to by Messrs. B. Nadin and P. J. Dell, who will continue the business under the same style.

PARKER & PARKES, electric welders, &c., Union Street, Newport.—Mr. W. G. Parkes and Mr. R. S. Parker have dissolved partnership. Debts will be attended to by Mr. W. G. Parkes.

NORTHAMPTON PLATING CO., electro-metallurgists and enamellers, 71, St. Giles Street, Northampton.—Mr. W. F. White and Mr. E. H. Nichols have dissolved partnership. Debts will be attended to by Mr. E. H. Nichols, who will continue the business.

SIMMS MOTOR UNITS, LTD.—Winding up voluntarily, in view of the sale of the undertaking to a new company. Liquidator, Mr. D. R. Duncan, Percy Buildings, Grease Street, Rathbone Place, W. 1. Meeting of creditors at Percy Buildings, May 27th.

SPANISH AND GENERAL WIRELESS TRUST, LTD.—Particulars of claims must be sent to the liquidator, Mr. S. Pears, 14, George Street, Mansion House, E.C., by June 22nd.

Socials.—The third of the Mazda House series of staff entertainments took place at Slater's Cannon Street Restaurant, on May 7th. At 6.30 p.m. the party of 100 sat down to progressive whist, and for upwards of 90 minutes played with relentless fervour for the prizes, which were distributed by Mr. F. Shaw, the chairman, at supper. During the meal a collection was taken for the waitresses, which, when counted, was found to include one farthing. It was returned to the only Scotsman in the room. After supper the company engaged in terpsichorean exercises, interspersed with songs rendered by various members of the B.T.H. staff.

Exeter Agricultural Show.—The Devon County Agricultural Association held their exhibition at Exeter during May 12th, 13th, and 14th. The exhibition generally was a huge success. On the electrical side were the following stands:—Austin Motor Co., Ltd., showing their 75-KW. autoplant; Studebaker, Ltd., Lalley light and power plants; R. A. Lister & Co., Ltd., Lister-Bruston plant; Brooking & Co. The last-named firm appeared to be the only electrical contracting and installation company exhibiting, with the result that they had a free run of inquiries, plus a very satisfactory order book, not only for their particular goods on show, but also for the goods shown by the manufacturers at the other stands. Brooking & Co. had on show the Madstrong set, also the Ingeco set by Worthington of pump fame. The Hoover vacuum cleaner was to be seen in operation, a special demonstrator being in attendance. A particular feature of the stand was the prominence given to Callender's Kaleeco wiring system, which is meeting with great success in the West of England. At their stand, Messrs. Wood & Ball represented the manufacturers with the idea of doing all that is possible to popularise the use of electricity in agriculture and like industries, and to render direct assistance to electrical contractors. They will be showing at Salisbury Show. Their various exhibits included the plants made by the New-Pelapone Engine Co., Ltd., of Leeds; St. Helens cab tires, C.T.S. cables and anti-corrosive fittings; lighting fittings, by Electrical Supplies Co.; electric self-starting switchboards, by Mr. T. Burgoyne, of Kingsbridge, Devon; batteries, by Pritchett and Gold and E.P. Storage Co., Ltd.; and motors, by Bruce Peebles and Co., of Edinburgh. We are informed that a particular feature of the Exeter Show was the mutual good feeling between the manufacturer and the contractor.

Important Armstrong-Whitworth Development.—It is announced that MESSRS. SIR W. G. ARMSTRONG, WHITWORTH AND CO., LTD., have entered into arrangements with an old-established Christiania firm of hydraulic engineers (Messrs. Jensen & Dahl), under which they will take up the manufacture in this country of water turbines to Jensen & Dahl designs. Messrs. Armstrong, Whitworth have opened a hydro-electric section at their offices at 8, Great George Street, Westminster, S.W. Messrs. Jensen & Dahl have been responsible for many important Norwegian and other hydro-electric enterprises. The British company referred to has the exclusive rights for the British Empire and South America.

A New Electric Heater. — The efficiency of electric heaters is limited by the melting point of the heating units and the lack of intimate contact between the heating units and the material to be heated. If the heaters are laid inside the containing vessel, there is no material of which they can be constructed that will not be attacked by electrolysis when saline or other solutions are being heated. A new form of heater for A.C. circuits, described in *Electrotechnische Zeitschrift*, consists of a vessel provided with a vertical channel through its interior, through which the magnetic circuit of a transformer passes. The energy is supplied to a coil wound around the magnetic circuit, and the heat is generated in a metal cylindrical wall interlinked with the magnetic circuit and forming the side or bottom of the vessel and acting as a secondary circuit to the transformer. The efficiency of a vessel of this type is nearly unity.

Liverpool Exhibition.—An interesting feature of the Liverpool Health and Homes Exhibition held at St. George's Hall, was the useful display of domestic electrical contrivances, for lighting, motive power, heating, &c. The exhibition was visited by thousands of people, who paid special attention to such exhibits.

Patent Application.—On June 16th, Mr. Justice Sargent, in the Chancery Division, will hear the petition of the Reason Manufacturing Co., Ltd., of Brighton, for an extension of the term of Patent No. 20,500, of 1905, for "Improvements in mercury electrolytes for electrolytic cells," and of Patent No. 20,770, for "Improvements in cathodes," both granted to H. S. Hatfield and the Reason Manufacturing Co., Ltd.

New Indian Companies.—Among the new companies recently formed in India are the Indian Enfield Cable Co., 4, Fairlie Place, Calcutta, capital 2,500,000 rupees, to manufacture and deal in electric wires, cables, &c.; and the Coal Fields Power Co., Calcutta, capital 1,500,000 rupees, to establish plant to generate electric energy for lighting and power purposes.

LIGHTING AND POWER NOTES.

Argentina. — COMPANY REPORT. — According to the recently-issued report of the Société d'Electricité de Rosario, the company is now supplying power to the extent of 25,230 KW. to 21,630 clients, as compared with 23,820 and 20,074 respectively a year ago. The output of the generating station during 1919 reached a total of 22,899,989 KW.-hours, an increase of 15 per cent. over 1918. The boilers at the generating station have been converted to use coal and petroleum as fuel in place of wood.

Australia. — MELBOURNE. — The recently-published abstract of the accounts of the City Electricity Supply undertaking, for the year ended December 31st last, shows that the total revenue amounted to £240,081, and the total expenditure to £134,854, leaving a gross balance of £105,227, apportioned as follows:—Interest on capital, &c., £23,885; depreciation and renewals account, £37,999; and appropriations, £43,343.

Ayr. — PROPOSED EXTENSIONS. — The Corporation is seeking authority from the Electricity Commissioners to install additional plant or build new works. An alternative scheme is to take a bulk supply from Kilmarnock.

Barnsley.—CHARGE FOR METERS.—The Electricity and Lighting Committee recommends that a rental of 1s. 6d. per quarter be charged on all electricity meters installed in premises the net rateable value of which exceeds £10, the rental to come into force as from June 1st.

EXTENSIONS APPROVED.—The Electricity Commissioners have sanctioned proposed extensions to the present electricity works. The Electricity Committee has received a report from the electrical engineer in connection with the progress of such extensions.

Blackpool.—FUTURE DEVELOPMENTS.—The Electricity Committee has authorised the electrical engineer to seek an interview with the Electricity Commissioners, to place before them the local position with regard to electricity generation and distribution, and to ascertain, if possible, their proposals for the future development of the electricity supply business on the West Coast. This followed the Committee's adoption of the recommendation to install additional boilers at the electricity works.

Bradford.—NEW CONDITION OF SUPPLY.—The Electricity Committee has announced that in future applicants for electricity must sign a special condition which provides that the Corporation reserves the right to suspend the supply if it is found necessary when the total demand for power exceeds the effective capacity of the plant at the works. The condition is the outcome of the difficulties which arose during the recent long breakdown period at the generating station.

Bury.—LOAN.—The Town Council is applying for permission to borrow £4,341 in order to carry out extensions to mains, services, and public lighting.

Burnley.—PROPOSED EXTENSIONS.—The demand for electric power for mills and workshops has increased to such an extent, that steps will shortly have to be taken to provide additional generating plant. The Town Council has been recommended to seek borrowing powers for £150,000 to provide this, although under the new scheme for the Mid-Lancashire area it is probable that at least two large generating stations will be erected at approved centres.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—An estimate of £3,400,000 has been submitted to the Ontario Legislature for the requirements this year of the provincial hydro-electric system, over £2,000,000 being for power development at Chippewa and Queenstown.—*The Times.*

Clacton-on-Sea. — PROPOSED PRICE INCREASE.—The Urban District Council has applied to the Electricity Commissioners for power to increase the price of electricity by not more than 50 per cent., to enable the undertaking to be run without loss. A new Diesel engine is to be installed at the works.

Continental.—FRANCE.—One of the greatest industrial regions in France is formed by the suburbs of Paris, where the Union d'Electricité has undertaken the task of providing a supply of light and power on terms favourable to the consumers. The company has already purchased the works of the suburban undertakers, and intends to retain as auxiliaries those which are able to work on an economical basis, whilst the others will be disposed of so as to redeem the purchase price. It has been decided to substitute for these old works a super-station with a total capacity of 200,000 KW., and equipped with steam turbo-alternator sets of from 35,000 to 40,000 KW., which sets will be, it is said, the largest in France down to the present time. The primary network will have a pressure of 60,000 volts, and it is expected that the company will be able to dispose of 500,000,000 KW.-hours on the completion of the station. The company's share capital was recently increased to 125,000,000 fr., and the issue of a loan of 80,000,000 is now in contemplation.

The new station which the Compagnie Hydroelectrique et du Gaz de Lyon has been building on the Gorges du Fier will shortly be working; it will have a capacity of 40,000 H.P.

The French Minister of Agriculture has just created an Upper Council of Water and Rural Engineering entrusted with the examination of all questions—technical, economic, financial, and judicial—relating to the development of water resources, control of water courses, and the application of electricity to agriculture. It is divided into three sections—water, rural engineering, legislation, and litigation.

SWEDEN.—Great strides have been made in Sweden in late years in the use of electricity in agriculture. Three great hydro-electric installations exist, which place at the disposal of farmers a considerable amount of energy. One of these is situated near Trollhattan, a second is near Hjemsjö, and the third belongs to the Southern Sweden Electric Co. The energy, in the first of the above installations, is transmitted to sub-stations, where the pressure is stepped down from 70,000 to 20,000 volts; to these sub-stations are linked others, which supply at from 1,500 to 3,000 volts, available for use within a radius of three or four miles, the subscribers themselves forming a distributing company and providing the capital for the construction of their own local network. The State gives help to companies of this kind by means of loans on favourable terms. The distributing companies unite together into district or central companies, with their own appointed engineers, who carry out inspections and schemes of improvement, and, on demand, give advice. The largest of these companies buys its own materials, at a considerable saving of expense and with the best guarantee of the type and quality of the purchases. The electric energy serves the most varied uses and operations; besides lighting, it is used to drive threshing machines, straw-presses, winnowers, straw-cutters, forage-cutters, lifts, cheese-churns, milkers, &c.—*Bolletino d'Informazioni Agrari.*

Among the new companies recently formed in Sweden, in connection with the utilisation of water-power in the generation and distribution of electrical energy are the Nasums Elektriska Kraft Aktiebolag, organised at Osby, and the Vikbolandets Elektriska Aktiebolag, formed at Norrkoping.

SWITZERLAND.—The recently issued report of the North-East Swiss Power Works Co. gives interesting information regarding the large new stations for which a general meeting is being asked to sanction an outlay of 114,000,000 fr. In the year 1916-17 the output totalled 149,000,000 KW.-hours; in 1918-19 it rose to 222,000,000 KW.-hours; for 1924-5 the requirements will reach 346,000,000 KW.-hours, which cannot be supplied by the existing stations at Beznau, Löntsch and Eglisau, the last-named only completed this spring, as their total output only amounts to 186,000,000 KW. for 3,000 hours. The deficiency cannot be met permanently by resort to outside supplies, which are both increasingly difficult to procure and ever rising in cost. Hence the company is planning the building of three new power stations, namely, the Etzelwerk, the Wäggitalwerk and a station on the Aare, near Gippingen. The first-named station will be built near Megglen, on the Sihl River, and will have a capacity of 70,000 KW. and a yearly output of 135,000,000 KW.-hours. Its estimated cost, 2·5 fold the outlay before the war, is 94,000,000 fr. The second-named station will be built at Siebnen, on the Wäggital River, and will have a capacity of 60,000 KW., and a yearly output of 80,000,000 KW.-hours. Its cost is estimated at 60,000,000 fr. The third station will be situated on the Aare, near Koblenz, and will have a capacity of 30,000 KW., and its output will bring the

aggregate up to 260,000,000 KW.-hours. The estimated cost of this station is 65,000,000 fr. To defray the outlay on these several stations to the extent of 114,000,000 fr., shares to the amount of 34,000,000 fr. will be created, and 80,000,000 fr. of bonds issued, raising the capital of the company to 70,000,000 fr., and the bond indebtedness to 105,000,000 fr. Cantons interested in the undertaking will take up the new shares in the following ratio:—Zurich, 42 per cent.; Argau, 32; Thurgau, 14; Schaffhausen, 9; Glarus, 2; and Zug, 1 per cent.

BAVARIA.—A new limited liability company is being floated in Mellrichstadt, whose object is the construction of a long-distance power transmission station for the uniform supply of the Rhön, Dernbac, Mellrichstadt, Königshofen, and Meiningen districts. The electricity works in each district are to be affiliated to the new company. To meet the excess costs of construction, the communes are paying a subsidy—amounting to 100 marks per head of the population—which is non-redeemable, and carries no interest.—*Economic Review.*

TURKEY.—La Société Ottomane d'Electricité, of Constantinople, has recently secured from the Turkish Government an extension of 33 years of its concession, the Government's right of purchase having also been delayed until 1943. The number of clients of the company increased during the past year from 12,137 to 12,894; the output of the generating station during the past year amounted to 25,696,500 KW.-hours, as against 28,111,150 KW.-hours in 1913.

ITALY.—In order to meet the increasing demand for electricity, the Società Bolognese di Elettricità has decided to considerably enlarge its steam-operated generating plant, no further available water power for the hydro-electric station being available.

Deal and Walmer.—TIME EXTENSION.—The Minister of Transport has extended, to September 30th, the time under the Deal and Walmer Gas and Electricity Act for the extension of mains.

Douglas (Isle of Man).—ELECTRICITY SUPPLY.—The Douglas Electric Light and Power Co., Ltd., and the Town Council have asked leave from the Tynwald Court to introduce Bills for the supply of electricity in the borough, and a committee has been deputed to recommend that the petition be granted.

East Ham.—LINKING UP.—Writing to the Corporation, the secretary of the Electricity Commission says:—

"Applications for the extension of generating plant have been received from the local authorities of East Ham, Barking and Ilford respectively, and the Electricity Commissioners are of opinion that it is inexpedient and contrary to the public interest that any further extensions of generating plant should be made at the above-named three places.

"A Conference of the Electrical Engineers of the three boroughs and districts and also of the Borough of West Ham was, therefore, summoned, and the engineers were invited by the Commissioners to state their views, it being understood that the Conference was to be without prejudice to the interests of any of the Councils whose engineers were present.

"As a result of this Conference, and at the request of the Commissioners, the engineers have inquired into the matter very fully in order to ascertain the further demands that are likely to arise in each district during the next three or four years, and an estimate of the cost of laying a transmission line to interconnect these three districts and the West Ham electricity undertaking has been prepared.

"A comparison of the cost of energy in each district if the further supply required be taken wholly from West Ham, with the cost of generation from an extended local station, shows that East Ham, Barking and Ilford would all benefit by such an arrangement.

"For the immediate additional supply of Barking and East Ham, the Ilford Council's station, now being extended and approaching completion, would be available, that is, for next winter's load, and afterwards the West Ham undertaking would find a further increase required."

Exeter.—NEW PLANT.—The Town Council has applied to the Commissioners for consent to install an additional turbo-alternator of 1,000 to 1,500 KW. capacity, for the winter load of 1921, at a cost of from £22,057 to £30,426.

EMPLOYES' WAGES.—The City Council, at a recent meeting, decided to adopt the award to electrical workers of the National Joint Industrial Council. A proposal to disregard this and withdraw from the Board was defeated.

Holmfirth.—PRICE INCREASE.—The price of electricity has been advanced to 9d. per unit on account of the continued increases in the prices of materials.

Hove.—BULK SUPPLY.—The Town Council has decided to adopt the Brighton Corporation's terms for a bulk supply. This is being taken as an alternative to extending the Hove plant, which has become out of date.

Iceland.—WATER POWER.—The exploitation of Iceland's waterfalls is a matter of great importance. The latent power is estimated at 1,000 million H.P., but has been very little utilised. The Icelandic Waterfall Commission is at present considering the granting of a concession to a Danish-Norwegian company which wishes to exploit some of the falls. It is intended to use the power for the manufacture of nitrogen, and for an extensive scheme of electrification. Among other schemes is one for the construction of a 200-km. electric railway, running from Reykjavik, east and south through the agricultural district, which, if carried out, would be Iceland's first railway.—*Economic Review.*

Leeds.—STRIKE.—About 200 labourers employed by the Electricity Department in laying cables, struck work because they had not been brought within the scope of the wages award as applied to the engineering and allied trades. The Corporation refused to negotiate on the matter till the men resumed work. The men decided to go back to work on May 11th, and negotiations were at once begun. The strikers are also claiming £5 per week, alleged arrears in wages since December 1st last.

Midlands.—JOINT ELECTRICITY AUTHORITY.—It is understood that it is proposed to form a joint electricity authority to include Stafford, Wolverhampton, Walsall, Wednesbury, West Bromwich, and the area covered by the Midland Electric Corporation, but eventually the authority will be extended to bring in also the Potteries and Shrewsbury. The inclusion is also suggested of a portion of the County of Cheshire, so that Crewe and Nantwich can be supplied from the proposed power station at Stoke. The area as outlined will comprise 2,100 sq. miles. It is considered that sites at Rugeley on the Trent, and Ironbridge on the Severn, offer the best facilities for the necessary supplies of water and fuel. At the former place an area of 45 acres can be obtained, sufficient to provide for a station of over 200,000-KW. capacity. The river will give condensing water by direct circulation for 75,000 KW. at a minimum, but by means of a dam the working capacity can be raised to 125,000 KW., or even higher. The station at Rugeley will be limited by the quantity of water available for condensing purposes, and the proposal is that the plant shall not be of a greater capacity than 60,000 KW. The covering of this wide area with a network of supply mains, it is considered, will create a bigger demand for electricity for many purposes, industrial and domestic. The total plant capacity of existing stations is something under 100,000 KW. The first portion of the new scheme to supplement, and in some cases to supplant, present sources of supply, is the erection of the new station at Stoke, the suggested capacity being at the outset 20,000 KW. produced by four turbo-alternators. The first section of the new station at Rugeley will also be undertaken, its initial capacity to be 30,000 KW. As these stations come into commission all plants other than those of the three-phase 50-cycle turbine type will be closed down. The capacity of the Stoke and Rugeley stations will be extended in accord with the demand, and not until they have fully developed will the Ironbridge station be built. In the initial stages the capital expenditure will probably be between three and four millions, but the cost of the completed scheme will be approximately 15 millions.

Stafford.—YEAR'S WORKING.—The annual report of the municipal electricity undertaking shows that after debiting loan charges and income-tax, and crediting dividends and rents, the result of the working for the year ended March 31st, 1920, was a net deficit of £302, which added to that of £562 brought forward, made a total deficit of £864. The sum of £1,000 out of the gross profits of £3,818 had been placed to the depreciation fund. For the year ending March last, the total sales amounted to 1,999,200 B. of T. units, as compared with 731,800 units for the 12 months ending March, 1913.

TRAMWAY AND RAILWAY NOTES.

Burton-on-Trent.—YEAR'S WORKING.—The tramway manager's recently-presented report states that, unless fares are substantially increased or a subsidy is granted from the rates, the undertaking will show a loss of £11,700 on the coming year. The chairman of the Tramways Committee states that the deficiency on the past year's working was £3,294, without the transfer of anything to the depreciation and renewals funds. A suggestion to substitute motor-omnibuses for the tramways met with no support owing to the initial cost and greater running expenses.

Canada.—RAILWAY ELECTRIFICATION.—One of the first sections likely to be converted to electrical operation in the proposed electrification of Canadian trunk lines will be the double-track line of the Grand Trunk Railway between Toronto, Hamilton, and Niagara Falls, a distance of 82 miles, says the *Electrical News.* The coal shortage has been very threatening for several seasons, making it urgently necessary to reduce the coal bill just as soon as the required additional electric power is available. Very important undertakings are now in hand, and well advanced for the supply of electric power. High-voltage D.C. operation is now beyond the experimental stage, and firmly established on other trunk lines, offering increased capacity and economy in operation beyond the most optimistic views of 10 years ago. The electrification of Toronto terminals, covering 15 miles, will require much study to overcome the many difficulties likely to be met with, following with the Hamilton terminals, a length of five miles. With these two terminals converted, the trunk lines connecting could be electrified early, including also the Niagara Falls terminal of two miles.

Continental.—ITALY.—In order to meet the excessive cost of coal for steam-raising purposes, the Société des Tramways de Turin proposes to electrify the branch provincial lines at

present worked by steam. In connection with the scheme an application has been made to the Italian Government for an annual subvention.

Sweden.—Railway Electrification.—The Swedish Committee of State has approved the Government proposal for the allotment in 1921 of a first instalment of 23,000,000 kroner in connection with the projected conversion of the State railway between Stockholm and Gothenberg to electric traction. The Committee expresses the expectation that the railway and hydro-electric administrations will co-operate in solving the question of the methods of transmitting power from the power network to the railway system.

East Ham.—New Equipment.—The Town Council has applied for a loan of £8,331 for 10 new sets of equipment for reconstructed tramcars.

Ilford.—Electric Vehicles.—An unopposed inquiry was held on May 13th into the application of the Urban District Council for a loan of £8,050 for the purchase of six electric vehicles for the collection of house refuse.

Liverpool.—Derailment.—Owing to a train being derailed on the electrified part of the L. & Y. Railway between Liverpool and Southport on May 14th, several hundreds of city workers were unable to get home until late in the evening.

Electric Vehicles.—An order for the supply of certain electric vehicles has been cancelled by the Liverpool Health Committee, and the city engineer has been instructed to make fresh inquiries.

London.—Railwaymen's Wages.—The Industrial Court, in an award governing the wages of employés in power and sub-stations and electrical grades on railways in the London district, issued on May 11th, gives an advance in time or day rates of 6s. per full ordinary week, or 1½d. per hour, according to the custom of payment on the various railways. The advance applies to male workers of 21 years and over who are in receipt of a war wage of 33s. 6d. per week and a bonus of 12½ per cent. on earnings. Half of the advance will be retrospective to March 31st, and the remainder payable on May 31st. The case of the workers was put to the Court by the Electrical Trades Union, which claimed an advance of 15s. per week for those of 18 years of age and over, and 10s. for apprentices and boys under 18. Where the practice before the war was to pay those under 21 years of age who were in receipt of the full rate for labourers the same advances as were granted to those over 21, the Court decided that that practice should be continued. A claim by the N.U.R. for an advance of 15s. per week for all men and women in the railway shops and 7s. 6d. for boys and girls, including all those employed in electric generating stations on railways in the United Kingdom, has also been decided by the Industrial Court, which held that the workers who were in receipt of a war wage of 33s. 6d. a week and the bonus of 12½ per cent. on earnings should receive the advances granted on March 23rd to workers in railway shops. The general alteration then made was similar to that reported above for electrical grades.—*The Times.*

Underground Fares.—The Bill promoted by the London Electric Railways seeking powers to increase the maximum fares came before a Select Committee of the House of Commons, on May 11th. Mr. E. Honoratus Lloyd, K.C., on behalf of the promoters, applied for an adjournment. He said that at the last moment they had received from the Minister of Transport a report on the Bill. The points raised by that report were very serious. He had not had an opportunity of placing the report before any one of the boards of directors of the companies. The report suggested that the Committee should not deal with the Bill as a whole, but that, at the most, some temporary powers should be granted, and that the whole matter should be referred to the Minister of Transport, so that he might decide on the actual rates to be charged. The report, Mr. Lloyd added, differed materially from what was said by the Minister in the House on the second reading of the Bill. Counsel for the local bodies which are opposing the Bill assented, and the Chairman adjourned the Committee until after the Whitsun holiday. The Bill as it stands proposes to increase the fares for first-class passengers to 3d. a mile, with a minimum fare of 4d., and for other classes to 1½d. a mile, with a minimum of 2d. Higher rates are also proposed for the conveyance of parcels. —*The Times.*

Accidents.—Traffic on the Victoria Embankment was held up on Wednesday, last week, owing to the derailment of a tramway-car.

Traffic on the Central London Railway was delayed for half an hour, early on the same day, between the Bank and Liverpool Street stations, owing to signal trouble.

Twenty minutes' delay was caused by a tramcar failing to take the points in Holborn on Thursday, last week.

As the result of a collision between a steam lorry and a tramcar at Streatham, on Saturday last, the latter was badly damaged and traffic was held up for a time.

Car-designing Competition.—The London County Council is contemplating a scheme for awarding a prize of £1,000 for what is considered the best design of car for the London services.

New Rolling Stock.—The Highways Committee of the London County Council recommends the purchase of 125 new cars of the "E. 1" type, having seats for 78 passengers each.

Middlesbrough.—New Stock.—The Corporation has sanctioned the purchase of nine new electric cars at a cost of £3,420 each.

Nelson.—Loan.—The Town Council has decided to seek borrowing powers to the extent of £36,000, the estimated cost of a new car-shed, workshops, machinery, and equipment for the tramways. The original estimated cost was £25,000.

Oldham.—Arbitration.—Arbitration proceedings in connection with the purchase of the Oldham, Ashton and Hyde Electric Tramway Co.'s undertaking by the local authorities, will take place in London next month.

Sunderland.—Converted Cars.—On the Corporation system a new all-enclosed car has been put into service. It is the first of six bogie-cars which are being converted at the local car sheds under the direction of the general manager, Mr. A. R. Dayson, and the rolling stock superintendent, Mr. R. Haswell. A new truck is used, which ensures smoother running, the motors are each of 30 H.P., and there are front exit gates. The upper deck is of the saloon pattern, with seats for 40 persons.

Taunton.—Price Dispute.—As the Tramway Co. will not consent to pay more than 2d. per unit for electricity for power (1·2d. per unit was paid under the agreement with the Corporation) the Town Council has decided to apply for the agreement to be set aside under the Courts (Emergency Powers) Act, 1919. The Town Council had asked the company to pay an increase of 100 per cent.

United States.—Monorail Traction.—A monorail system of the type built in Germany 18 years ago has been offered to Chicago's City Traction Commission as a solution of the traction problem, says *Electric Traction*. A model was set up for demonstration by the National Suspended Monorail Co., and, according to the promoters, the system can be operated at a saving of 65 per cent. over the systems now in use. It is claimed that 70 per cent. of the accidents would be eliminated, and that the time of journey would be reduced 50 per cent. There would be no grade crossings, and noise would be eliminated by fitting to the wheels tires made of vulcanised wood fibre. With regard to cost, it is claimed that the system would cost only $100,000 per double-track mile; it is estimated that the cars would have a speed of 130 M.P.H., but in actual service would make 42 M.P.H. with one stop per mile, and 32 M.P.H. in local service. The cars would weigh 12 tons each, and would contain 60 seats per car. The structure, from which the cars would be suspended without the use of under wheels, would be supported every 50 ft. by supports erected on one side of the street only.

TELEGRAPH AND TELEPHONE NOTES.

Bradford.—Wireless Telephony.—The newly-formed Bradford Wireless Society is proposing to erect a wireless station, if permission can be obtained from the Postmaster-General. On May 12th, at a meeting of the Society held at Heaton by the kindness of the President of the Society (Mr. Charles Wood), whose apparatus was used, the members were able to enjoy a concert which took place at the Chelmsford Marconi station, 170 miles away.

Lerwick.—Wireless Station.—The early closing of the wireless station is foreshadowed in an Admiralty order stating that all outstanding demands for stores from this station are to be considered as cancelled. The naval base was closed down on December 13th last, and the Nab Port war signal station was closed on December 18th.—*The Times.*

London.—Wireless Telephony.—The efficiency of wireless telephony as a means of communication between the scenes of fires and the Brigade headquarters in the City was tested at a demonstration in London on Friday, last week. The transmitting and receiving apparatus was carried on the back of a tender, and as soon as it came into position at a pre-arranged spot at Clapham Common, S.W., a pole was hoisted on the tender bearing one end of the aerial wire, the other end being run out and attached to the top of the nearest lamp-post. At the spot chosen for the demonstration there was no ordinary telephone within reasonable distance.

Post Office Employés' Wages.—The Union of Post Office Workers at its annual conference at Morecambe on May 11th accepted the Government offer on the claim made by the Union for a flat wage increase of 10s. per week. The Government offered an immediate increase of 3s. 6d. a week to men and 2s. 6d. to women. This increase is for the main classes only—namely, outdoor postmen, telegraphists and telephonists, and indoor sorting clerks. The usual increments continue, and such a reduction in office classification is arranged as ensures earlier attainment of the maximum. Apart from the money offer, there is secured a reduction of provincial scales from five to three, an extension of the London area to a 12 miles radius from Charing Cross, the existing London area to be Division I, and the new outer area Division II. The wage increases indicated date back to January 1st, and are proportionately extended to overtime worked since that date. The increases secured by the main classes will be the basis of settlement for other classes, and will date back to January 1st.

Telegraph Rates.—The daily Press announces that the new telegraph rates are to be dealt with in a Parliamentary Bill, and will not come into operation on June 1st as was suggested.

Underground Cables.—Underground telephone cables are now being laid by the General Post Office in most of the business centres of the country with the object of improving the stability of the service. One of the ducts now under construction runs from London to Manchester, and is reported to be nearing

completion. A start has been made in drawing in the cables. A duct has also been made for the greater part of the distance between London and Bristol, while good progress is reported with that which will connect London with Southampton. The cables between Glasgow and Coatbridge, Dumbarton and Motherwell will soon be ready, while on the short distance between Ormskirk and Preston the arrangements are practically complete. Schemes for linking up Manchester and Liverpool, Bolton and Rochdale, and for connecting Liverpool and Chester are well in hand; and preparations are being made for the underground linking-up of business towns in the Midlands, particularly in the Birmingham district. *The Times* says that it is expected that the whole scheme will be nearing completion towards the end of the present year.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Australia.— MELBOURNE.—May 31st. Victorian Railways Department. Four 4,500-KW., 1,500-volt traction converter sets, and eight 1,000-KW., 1,500-volt ditto. (April 30th.)

SYDNEY. — August 4th. N.S.W. Government Railways and Tramways. Two 1,000-KW. sub-station units. Chief Electrical Engineer, 61, Hunter Street, Sydney.

August 3rd. Department of Public Works. Turbines and generators for the Barren Jack hydro-electric development scheme. Department of Public Works, Sydney.

July 18th. City Council. Maximum demand indicators. Electric Lighting Department, Town Hall, Sydney.

PERTH. — July 14th. P.M.G.'s Department. Telegraph and telephone instruments (various parts). Schedule 674.

June 16th. P.M.G.'s Department. Telegraph and telephone instruments (various parts). Schedule 680. (May 14th.)

ADELAIDE.—June 23rd. P.M.G.'s Department. Telephone parts (schedule 541). (See this issue.)

Barnes.—June 7th. Urban District Council Electricity Department. Coal-handling plant and overhead steel or ferro-concrete bunkers. (May 14th.)

Belgium.—June 18th. The municipal authorities of Verlaine (Province of Liége) are inviting tenders for the concession for the supply of electrical energy for lighting and power purposes in the district. Particulars can be obtained from the Maison Communale.

Dublin.— June 7th. Electricity Supply Committee. 12 months' supply of single-phase and three-phase meters.

June 1st. Electricity Supply Committee. 22 direct-current magazine flame arc lamps. (See this issue.)

Edinburgh.—June 19th. Electricity Supply Department. E.H.T. and L.T. switchgear, &c., for Portobello station. (See this issue.)

Lincoln.—May 24th. Electricity Department. Coal-handling plant. (April 23rd.)

Leeds.—June 14th. Electricity Department. 12,000-KW. steam turbine, alternator and condensing plant. (May 14th.)

London.—HACKNEY.—June 9th. Electricity Department. Four water-tube boilers, each 33,000 lb. per hour capacity, with superheaters, mechanical stokers, &c.; four induced-draught plants; four fuel economisers; one 10,000-KW. turbo-alternator and exciter, with ventilating fan and air filter or cooler; one surface condensing plant; two circulating water motor-driven pumps; E.H.T. switchgear; two 20,000-KW. coupler panels; one 10,000-KW. generator panel; six 2,000-KW. and one 4,000-KW. feeder panels. (May 7th.)

BETHNAL GREEN.—June 7th. Electricity Supply Department. Two 500-K.V.A. transformers; one E.H.T. and one L.T. panel; L.T. feeder cables; section pillars and road work. (See this issue.)

Manchester.—June 7th. Electricity Department. Main and auxiliary switchgear; Section A, 33,000-volt and 6,000-volt main switchgear; Section B, pressure-testing switchgear; Section C, 420-volt A.C. auxiliary switchgear; Section D, 240-volt D.C. auxiliary switchgear. (April 30th.)

New Zealand.—WELLINGTON.—June 30th. Tender Board. Public Works. Electrical equipment for the Arthur's Pass section of the Midland Railway. Particulars from the Department of Overseas Trade, 73, Basinghall Street, E.C.

AUCKLAND.—September 1st. Harbour Board. For the supply of electric capstans and spares. Messrs. W. & A. McArthur, Ltd., 18-19, Silk Street, Cripplegate, London, E.C. 2.

Salford.—June 5th. Electricity Department. 12 months' supply of D.C. and A.C. meters. (See this issue.)

Trimdon.—May 25th. Parish Council. Overhauling and repairing the whole of the electric lighting in the villages of Trimdon Grange and Trimdon Colliery. Mr. T. W. Wilkinson, Clerk to the Council, 24, Booth View, Trimdon Grange.

CLOSED.

Bradford.—Electricity Committee :—

Steelwork for firing floor of new boilers.—Redpath, Brown & Co., Ltd.
19 feeder and fuse pillars.—B. I. & Helsby Cables, Ltd.
Steel gangways for pump room at Valley Road works.—F. Fox.

London.—Metropolitan Water Board. Works Committee. Recommended :—

Electrical water-level indicators at 12 reservoirs in Kent, £1,720 approx.—Glenfield & Kennedy, Ltd.

Margate.—Town Council :—

Renewal of electric light installation, pavilion and winter gardens, outside arena.—W. J. Cannon, £190.

Pontefract.—Town Council :—

Electric light installation, assembly rooms.—A. Brook, £52.

Sunderland.—Electricity Committee. Accepted :—

J. Hewdins & Co.—Parts for A.E.G. turbine.
Elliott Bros.—Test-room instruments.
General Electric Co., Ltd.—Seven circuit breakers.
B. I. & Helsby Cables, Ltd.—Cable wagon, E.H.T. cable, 4-core L.T. network cable.
C. C. Wakefield & Co.—Turbine oil.
Ferranti, Ltd.—House-service meters.

Wolverhampton.—Tramways Committee. Recommended :

5,000-gallon petrol storage tank, complete, £474.—Alexander & Steer.
One spare engine and spare back axle for motor omnibuses, £500.—Tilling-Stevens Motors, Ltd.
The Committee recommends the Council to agree to the payment of £896, being 7½% increase in the price of omnibuses, under the emergency clause of the contract with Tilling-Stevens Motors, Ltd.
Two sets of Crellin's patent car body lifting apparatus, £304.—C. Booth and Co.

Electricity Committee. Recommended :—

Three self-balance current transformers; one Fawsett-Parry relay; three 33,000-v. M.P. feeder-current transformers, £172, plus £66 cost of erection.—Reyrolle & Co., Ltd.
Two 500-KW. converters, £3,762 each (revised tender).—Met. Elecl. Co., Ltd.
One 225-KW. mercury arc rectifier equipment, £2,577.—Power Rectifiers, Ltd.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Friday, May 21st. At Albemarle Street, W. At 9 p.m. Lecture on "The Thermionic Valve in Wireless Telegraphy and Telephony," by Prof. J. A. Fleming, F.R.S.

Friday, May 28th. At Albemarle Street, W. At 9 p.m. Lecture on "Crystal Structure," by Prof. Sir W. H. Bragg.

Junior Institution of Engineers.—Friday, May 21st. At 39, Victoria Street, S.W. At 7.30 p.m. Social evening.

Friday, May 28th. At 7.30 p.m. Lecturette on "Two Years as an Engineer in the Grand Fleet," by Mr. A. Arnold.

Royal Society of Arts.—Friday, May 28th. At John Street, Adelphi, W.C. At 4.30 p.m. Paper on "Lignite," by Prof. W. A. Bone, F.R.S.

Electrical Power Engineers' Association (Southern Division, London Industrial Section).—Friday, May 28th. At Anderton's Hotel, Fleet Street. At 7.30 p.m. Open meeting.

Physical Society of London.—Friday, May 28th. At the Imperial College of Science, South Kensington. At 5 p.m. Discussion on "X-Ray Spectra," to be opened by the President, Sir W. H. Bragg, F.R.S.

NOTES.

British Oil.—In reply to a question in the House of Commons, Mr. Kellaway stated, on May 11th, that of the 11 wells which had been drilled, one had been abandoned owing to the difficulty of eliminating large quantities of water encountered. Traces of oil had been found in five wells, and one well at Hardstoft, Derbyshire, had a natural flow of 50 barrels per week. An experiment had shown that it would be possible to increase the yield to 250 barrels per week. The total oil produced to date was about 2,800 barrels, or 100,000 gallons. The oil was being stored pending a decision concerning oil rights in this country. Drilling was proceeding in nine other wells.

Mr. Bonar Law, in Parliament on May 13th, stated that the Government had reached a decision regarding the ownership of royalties on oil deposits in Great Britain. A Bill had been drafted, and was receiving the consideration of the Government.

Industrial League and Council.—The half-yearly dinner is to be held in the Wharncliffe Room, Hotel Great Central, Marylebone Station, N.W., on Wednesday, May 26th, at 7 p.m. Mr. H. E. Blain, C.B.E., will take the chair, and the speakers will be Sir Allan M. Smith, K.B.E., M.P., and Mr. W. H. Hutchinson (A.S.E. Executive).

Inquiries.—Addresses of makers of the Stuart centrifugal pump, and Kitching's Crownall shade carrier and light diffusing globe, are asked for.

Mr. F. Ayton and the Electric Vehicle Manufacturers.—On Monday last, at the Restaurant Frascati, the electric vehicle manufacturers gave a dinner in honour of Mr. Frank Ayton, M.I.E.E., chairman and hon. secretary of the Electric Vehicle Committee of Great Britain and Ireland, and chief engineer and manager of the Electricity Supply and Tramways Department of the Corporation of Ipswich. Mr. W. H. L. Watson, of Edison Accumulators, Ltd., presided over a gathering of some 60 members of the electric vehicle industry, representing manufacturers of vehicles, batteries, switchgear, and other components. After the toast of "The King" had been honoured, the Chairman proposed the health of Mr. Ayton, recalling the early days when things used to look very black in the electric vehicle industry; at that time Mr. Ayton joined hands with him, and was responsible for the formation of the Electric Vehicle Committee of the I.M.E.A. Since then Mr. Ayton had never relaxed his efforts, in spite of his many onerous duties. Presenting him with a draft for 250 guineas and a silver rose bowl, the Chairman expressed the hope that they would continue to have his assistance in the future. The toast was drunk with musical honours, and Mr. Ayton, in responding, said he could find no words adequately to thank them for their splendid appreciation of his work, which would have been of no avail had he not had the wholehearted support of the committee. He paid a special tribute to the work of Mr. R. A. Chattock, the first chairman of the committee. They were on the threshold of a very big development in the use of the electric vehicle not only of the commercial but also of the pleasure type.

Major WHITTINGTON, proposing "The Electric Vehicle Committee," said he had had experience with horse, petrol, and electric vehicles; the horse drivers, by the adoption of the 8-hour system, had reduced the mileage of a horsed van to 20 or 25 miles a day, there was a prospect of great scarcity of petrol, and the electric vehicle therefore had a great future at hand. Mr. SHRAPNELL SMITH responded, pointing out that the electric vehicle had had to make headway here as a newcomer, whereas in the United States it was in extended use before the petrol truck was developed.

Mr. A. S. MAYS-SMITH (of Motor Manufacturers & Traders, Ltd.) proposed "The Electric Motor Industry," and Mr. E. C. RANSOME (of Messrs. Ransomes, Sims & Jefferies, Ltd.) responded, referring to the high esteem in which Mr. Ayton was held in Ipswich. Mr. E. W. CURTIS also replied with a humorous speech. Mr. V. W. BONE proposed "The Chairman," suggesting that the gathering should become an annual event, and Mr. WATSON, in responding, said that an Electric Vehicle Manufacturers' Association was in course of organisation to co-operate with the Electric Vehicle Committee. Mr. KEMP, proposing "The Visitors," said that in and around Birmingham there were electric vehicles worth £250,000 in use. Charging facilities were the greatest need of the time. Mr. W. E. WARRILOW responded, referring to the hard times in the past and the brilliant prospects for the future of the electric vehicle. At a later stage Mr. AYTON stated that in the past municipalities had met with great difficulties in getting sanction to loans for providing garages and charging facilities; those troubles were now at an end. Applying to the Electricity Commissioners for such powers for Ipswich Corporation, he was assured that the Commissioners were anxious to encourage the use of the electric vehicle, and such applications would receive favourable consideration.

An excellent concert was provided, Mr. S. G. Trehearne being the musical director; amongst the performers were Messrs. Deverill, A. J. Makower, and Kemp, and a novel feature was introduced in the form of two charming dances in costume performed by Miss Mildred Challenger and Miss Thelma Trehearne, which were highly appreciated by the spectators.

Charges for Electricity Supply and Wages of Employes. The following resolution was passed at the last meeting of the Home Counties Industrial Council:—

Resolved: That the Minister of Transport be asked to receive a deputation from the Home Counties Industrial Council for the Electricity Supply Industry with a view to pressing that the statutory charges authorised for electricity supply undertakings be increased where necessary to such degree as to enable them to pay such wages as agreed upon by the Industrial Councils as proper and reasonable for the electricity supply industry, and that the Minister of Transport embody an instruction that such increase shall be devoted primarily to such purposes and that such increases should be given only to such undertakings carrying out the recommendations of the Industrial Councils.

The deputation, fully representative of both the employers and Trade Unions, were received by the Electricity Commissioners, Sir John Snell, Sir Harry Haworth, and Mr. Harry Booth, on Wednesday.

Alderman Wilkinson, of Luton, explained the position generally. He said that the Industrial Councils were charged with the care of all matters concerning the relation of employers and employés, and that nothing could be more pertinent in this connection than the request in the resolution, namely, that the Minister of Transport should afford relief where necessary to undertakings, so that they should be in a position to pay wages as recommended by the Industrial Council. Many claimed that they could not do this at present, and for these he asked that an increase in their maximum prices should be accorded. But he specially emphasised that each such increase should have a proviso that it was conditional upon wages being paid as recommended by the Industrial Council.

Mr. G. W. Spencer-Hawes supported the case by a detailed statement on the financial position of the undertakings in question.

Mr. J. Meakins, of the Enginemen's Union, explained the position of the Trade Union, followed by Mr. Morton and Mr. W. T. Webb, of the Electrical Trades Union, who emphasised the fact that the Union most strongly urged that the wages question should be tied up with any increases granted, as that was the only ground on which the Unions supported the deputation. It was suggested that in future whenever applications from undertakings were made to the Minister of Transport for increase of charges, the Ministry should notify each case to the Industrial Council concerned and if necessary give it power to attend to oppose.

Sir John Snell, after dealing with the legal difficulties involved, expressed himself as appreciating the points at issue, and said that the matter would receive the immediate and most careful attention of the Electricity Commissioners.

Appointments Vacant.—Shift engineer (£223), for the Farnworth Urban District Council Electricity Department; works superintendent (£260 to £300), for the Aylesbury Urban District Council Electricity Works; cable jointer, for the Barrow-in-Furness Corporation Electricity Department; temporary draughtsman (£350), for University College, London; meter tester (86s., rising to £5), for the Hull Corporation Electricity Department; working assistant engineer (£200), for the Hants County Asylum; mains engineer (Rs. 540 per month), for the Calcutta Electric Supply Corporation; sub-station attendant (77s. 9d.), for the Stalybridge, Hyde, &c., Electricity Board; shift engineer (£229), for the City of York Electricity Department; electrical foreman (Rs. 360 per month), in the Locomotive Carriage and Wagon Department, of the South Indian Railway Company. See our advertisement pages to-day.

L.C.C. Appointments.—The Highways Committee of the L.C.C. proposes to invite applications by public advertisement for the three undermentioned vacancies, it being provided that members of the Council's staff will not be precluded from applying:—

(i) Electrical branch. Technical assistant, Grade I.—Salary, based on pre-war conditions, £300 to £400 a year. Total remuneration, including present temporary additions, £480 to £600 a year.

(ii) Electrical branch. Technical assistants, Grade II.—Salary, based on pre-war conditions, £250 to £300 a year. Total remuneration, including present temporary additions, £420 to £480 a year.

(iii) Permanent way branch. Technical assistant, Grade III.—Salary, based on pre-war conditions, £200 to £250 a year. Total remuneration, including present temporary additions, £320 to £385 a year.

Italian Agricultural Machinery Exhibition.—Under the auspices of the Ministero per l'Agricoltura and various societies, including the Unione Esercenti Imprese Elettriche, there is to be held at Rome in August and September, an International Exhibition of Agricultural Machinery. Complementary applications of electricity in subsidiary agricultural operations will also be represented.

The "Lyto" Dry Cell.—Messrs. T. E. Slaughter & Co. ask us to say that their correct address is 172, Church Road, Mitcham, London, S.W.

Service Notes.—Orders have been issued by the Admiralty to the effect that the greatest possible economy is to be exercised by the ships which take electrical power and lighting from Dockyard mains.

Commissioned Electrician F. B. Etherington has been appointed to H.M.S. *Centurion*, from the 6th inst.; Warrant Electrician A. E. Griffin, to H.M.S. *Vernon*, for the Mining School, from the 6th inst.; Warrant Electrician R. Brimacombe, to H.M.S. *Sandhurst*; Captain G. F. Bone, Devon Fortress Engineers (Electric Lights), who recently ceased to do duty with the Machine Gun Corps, has been restored to the establishment of his regiment, with which he has served since 1915; Lieutenant N. W. L. Stafford, Lancashire Fortress Engineers, has been restored to the establishment of his regiment on ceasing to be employed on the staff.

Educational.—UNIVERSITY OF LONDON.—A course of four Advanced Lectures on High-Frequency Alternators for Radio-Telegraphy, by M. Marius Latour, will be given at the Institution of Civil Engineers, Great George Street, S.W., on May 26th and following days, commencing at 5.30 p.m. Admission is free to the lectures. For further particulars see our advertisement pages to-day.

The Kinema in School.—Ealing is considering the extension of its school kinema enterprise by the purchase of film-making apparatus.

Fatalities.—An inquest was held at South Shields last week upon the body of Robert Henderson (37), an electric crane driver, who was killed while following his employment at the shipbuilding yard of Messrs. John Redhead & Sons. Henderson, it was stated, was cleaning the electric crane in the engine works, and had been warned by the foreman and another man that the current was on. He was engaged on the upper part of the crane when he was heard to give a loud groan and seen to fall off the crane. He struck some shafting and fell upon some boxes 25 ft. below. When he was picked up, life was extinct. The foreman of the jury expressed the opinion that deceased, instead of going towards the permanent ladder, had been taking a short-cut under the live wires to another ladder which was standing against the crane.—A verdict that death was the result of an electric shock and fracture of the skull was returned.

INSTITUTION NOTES.

Institution of Electrical Engineers.—WESTERN CENTRE.—At Cardiff, on April 12th, Prof. F. Bacon lectured before this Centre on "Thermionic Valves." The lecture was followed by a discussion, and various types of valves and valve apparatus were exhibited. The lecture was illustrated by lantern slides, and a number of experimental demonstrations were made by the lecturer.

Recapitulating the main points of the lecture, there was, said the lecturer, first, a broad division between two-electrode valves, or thermionic rectifiers, and three-electrode valves, in which a grid, spiral, or other form of "control" electrode was interposed between the filament and the plate. Then there was a fundamental physical difference between the present-day hard valve, in which the vacuum was so high that the pure electronic discharge from the incandescent filament was not perceptibly interfered with by the molecules of the residual gas, in contradistinction to the "soft" or "gas" valve, in which the molecules of the residual gas played an essential part by supplying positive ions, which carried the bulk of the current and largely neutralised the space-charge effect. Considering a mechanical analogy, hard valves were like hydraulic valves of small size closed by a stiff spring; soft or gas valves were like pneumatic valves of large area and closed by a very weak spring. Next, one could draw distinctions between the material nature of the cathode and the method employed for causing it to emit electrons. By calling a valve "thermionic," they limited themselves to the employment of cathodes in which thermal agitation was used for provoking the emission of electrons. In a broad review of the subject, however, it seemed legitimate and desirable to include mercury rectifiers and Pointolites as special forms of soft thermionic valves, in which the hot spot on the cathode was maintained by bombardment of positive ions assisted by high current density. The standard form of cathode for the ordinary thermionic valve was a filament of tungsten heated by a separate source of low-tension supply, which might be either D.C. or A.C. For valves employed in reception circuits, which included telephones, every precaution had to be taken to avoid coupling to sources of supply containing ripples of audible frequency. For instance, the telephones would scream if filament heating or plate voltage was obtained from ordinary supply mains. In such cases it was imperative that only batteries of primary or secondary cells be used. In other cases, however, it was quite satisfactory, and generally preferable, to heat the filaments with low-tension A.C. obtained from the secondary of a special heating transformer. The only alternative to the tungsten filament that had been used to any extent in thermionic valves was the Wehnelt cathode, consisting of a filament of platinum coated with lime or other oxides. Such filaments had high efficiency in that they emitted a great number of electrons per watt expended in heating; but they rapidly disintegrated, and were not suitable for the modern hard valve. Perhaps the very rapidity and completeness with which the three-electrode valve had fulfilled every requirement and surpassed every expectation of the wireless engineer had tended to distract attention from the useful possibilities of the two-electrode valve, both of the hard and soft varieties, to the electrical power engineer. In this connection, the lecturer had attempted to draw attention to certain modest yet useful functions which it could already discharge. The mercury rectifier already bade fair to oust the rotary converter, and the practical difficulties which stood in the way of building thermionic valves in steel containing vessels, suitable for heavy currents, were to a great extent the same as those which had just been surmounted in the case of the mercury rectifier. It would be rash to pooh-pooh the idea that they might be on the eve of great things due to the introduction of some improved, enlarged, and robust type of thermionic valve into the main distribution schemes of heavy electrical engineering.

It will be remembered that a small deputation of members of the Institution, representative of the various branches of the industry, visited Holland in September, 1919, at the invitation of the Dutch Association of Electricity Works' Managers. Arrangements are being made for a return visit of Dutch engineers to this country in July next. It is hoped that the visitors will also take part in the summer meeting of the Institution at its Western Centre.

Association of Mining Electrical Engineers.—Developments in the application of electrical machinery in mines were foreshadowed in a paper read before the Yorkshire branch of the Association at Wakefield on April 16th, by MR. J. R. HAIGH, engineer at the Lofthouse Colliery, who said that the first requisite was to pass an electrical wave of enthusiasm through the management, and remove the bias from the minds of the majority of engineers at most collieries. It could be proved that by the application of electricity, £200 per week had been saved in the boiler fuel consumption alone. The whole training of a colliery engineer needed drastic revision; it was the worst policy to install valuable plant and then advertise for the cheapest man to look after it. The first step towards reducing the cost of working on the surface was to remove that most prolific source of waste—the steam exhausted into the atmosphere. This exhaust from the winding engines could be made to generate sufficient electricity to drive the whole of the auxiliary plant and leave a surplus for further extension. Scrapping the old wasteful steam winding engines was too drastic a policy, but by removing the old cylinders and replacing them with Corliss valve gear, a few more tons per shift could be wound. From 20 to 25 per cent. could be easily saved by housing the boilers and lagging the steam ranges, instead of leaving them exposed to the elements. By the introduction of stokers designed to burn unsaleable coal, 200 to 250 tons per week could be burnt upon the grates of Lancashire boilers. Every steam engine on the surface, and all steam pumps in the shaft, should be superseded by electric motors. With regard to new collieries, the author advocated still more complete electrification. Electric winders would be employed; there was a limit to the depth from which coal could be wound by steam plant, whereas by electric winders it would be possible to win coal from depths not yet dreamt of. In the future when the seams near the surface had been worked out, seams of thicker sections than those at present worked would be found, and the only means to win these seams would be by the electrical energy raising the coal from the lower levels to those already worked out, by a succession of winding gears, the tubs being electrically transferred from one cage to the other. The system of ventilation could be carried on in the same way. Electric winders gave smoother acceleration, and the ropes lasted longer; they gave easier methods to secure safe working and freedom from over-winding, and automatic arrangements were easier to adopt. Decking arrangements could also be made more cheaply by electrical appliances. The screening plant should also be electrically-driven, wagons under the screens propelled by electric capstans, and any other haulage should be by electric locomotives in preference to the expensive steam locomotives. The rest of the surface plant should be electrically-driven, and the provision of an electric welding shop, Mr. Haigh showed, would effect great economies in the production of tubs, as one man could weld the plates together and make a good strong tub in three hours; repairs to the various plant could also be effected more economically and expeditiously by electric welding. No animal should be allowed underground in the colliery of the future; the whole of the haulage should be accomplished by electric battery locomotives getting right up to the coal face. Finally, Mr. Haigh urged the need of a school at each mine where all the workers could see scientific experiments carried out and hear lectures, so that they might intelligently understand the mechanism which they were called upon to manipulate. Nothing hindered production like ignorance; the miner should be educated to understand the possibilities of the mysterious power which had come to his assistance, and to treat it in a manner which could only lead to the end in view—increased production.

At a meeting of the Association at Leeds, on May 8th, the following officers were elected for the year 1920-21:—President, Mr. J. W. Harbottle (Fryston); vice presidents, Mr. J. W. Mitchell (Barnsley) and Mr. J. T. Lee (Featherstone); hon. secretary and treasurer, Mr. W. Winter (Castleford); auditor, Mr. H. Green; council, Messrs. R. Holiday (Ackton Hall), A. R. Clayton (Dewsbury), F. Mawson (Wakefield), Major F. Mellor (Leeds), Mr. J. H. Haigh (Lofthouse), Mr. E. A. Moorhouse (Nostell) and Mr. T. Crossley (Barnsley).

Royal Institution.—On Saturday, May 29th, Prof. J. H. Jeans commences a course of two lectures on "Recent Revolutions in Physical Science." (1) "The Theory of Relativity"; (2) "The Theory of Quanta." The Friday evening discourse on May 28th, will be delivered by Prof. Sir W. H. Bragg on "Crystal Structure," and on June 4th by Sir Ronald Ross on "Science and Poetry."

Wireless Society of London.—At a meeting of the Society held on April 30th, a paper was read on an automatic call device by Major Basil Binyon, O.B.E. By means of an aerial which had been erected, Major Binyon was able to give a practical working demonstration of the mechanism. Pre-arranged messages were received from his wireless station at Slough, and the selector mechanism proved beyond doubt that it would respond only to signals which it was set to receive. By the use of this apparatus it is, therefore, possible to make use of only one operator on board ship, so that during the less busy hours of the day the automatic call device may be left to take incoming signals, and on the receipt of a message giving the call signal of the ship in which it is installed, or the distress signal S.O.S., a relay is put in action, a bell rung, and the operator called to his instruments.

Twenty new members and associate members were elected, including the Society's first lady member.

The Institute of Metals.—The annual autumn meeting will be held at Barrow-in Furness, on September 15th and 16th next. Particulars can be obtained from the Secretary, Mr. G. Shaw Scott, M.Sc., 36, Victoria Street, S.W. 1. The annual May Lecture will be delivered by Prof. C. A. F. Benedicks, Ph.D., at 8 p.m., on June 10th, at the Institution of Mechanical Engineers, Storey's Gate, Westminster, the subject being "Recent Progress in Thermo-Electricity." Prior to the lecture a ballot for the election of members and students will take place. Persons so elected will be entitled to be present both at the lecture and at the Barrow meeting, whilst their first annual subscription will cover the extended period ending June 30th, 1921. Membership forms can be obtained from the above address.

Edinburgh Electrical Society.—At the annual meeting held on May 12th, Mr. T. S. Munnoch, chairman, referred to the excellent progress made by the society during the first year of its existence. The treasurer submitted a gratifying account of the financial condition of the society, which, without calling on the support of patrons, was more than paying its way. Prizes were presented to three apprentice members for papers which they had submitted for competition, and president and secretary were thanked for their good services during the year.

The office bearers for next session were elected as follows:—Chairman, Mr. Donald Macintosh; vice-chairman, Mr. D. S. Munro; committee, Messrs. Law, McLean, Stark, and Bee; hon. secretary and treasurer, Mr. W. S. Johnson, 11, Comely Bank Street, Edinburgh.

It was decided to open next session with a social function, to be held during September, and the secretary is now open to receive papers to be included in the new syllabus.

North-East Coast Institution of Engineers and Shipbuilders.—At Newcastle-on-Tyne, on April 30th, Mr. J. S. Watson read a paper on "A Modern Power Station and Its Development," and discussed the subject by tracing the development which had taken place in connection with the generating plant installed by the Newcastle-on-Tyne Electric Supply Co., Ltd. The historical aspect of the subject was dealt with by dividing the period of 29 years into four stages. Before dealing with the various stages in detail, Mr. Watson mentioned the important fact that plant in the various stages was superseded and scrapped, not because it was worn out, but because in the march of science, other plant so much more efficient had been developed that it no longer paid to run the old plant. During the gradual development of Carville "A" station, the utilisation of waste heat in connection with the working of coke ovens and blast furnaces received the special attention of the company, and the third, or waste-heat, stage of development was entered. The location of the waste-heat stations was decided by the position of the coke-oven and blast-furnace plant from which the waste power could be obtained. The turbines consisted of either high-pressure, or exhaust-steam, plant depending on the class of power available. The object in view being to utilise to the full the waste power available at the lowest possible labour cost, no spare plant was provided, and the station ran at the maximum capacity possible, any variation being met by larger coal-fired stations. The waste-power stations ran continuously, except for the period of overhaul necessary from time to time. Continued demands necessitated the provision of further plant with the result that the fourth stage was arrived at. It was then decided to erect another station now known as Carville "B," having a capacity of 50,000 KW. As this was the last station to be brought into commission, and as it showed a further marked improvement in economy, the author gave a more detailed description of the plant.

It was claimed that the station described was the most efficient, not only in this country, but probably in the world. The returns issued by the Coal Mines Department of the Board of Trade showed that on the North-East Coast where coal was relatively abundant, and of a low price, the most economical generating plant was in operation. The author emphasised the fact that the characteristic changes which had taken place in all stages had been :—The increase in boiler pressure, increase in steam pressure, the higher speed of plant (consistent with the periodicity of the system), the larger individual size of the generating units, and the more complete utilisation of labour-saving appliances. The principal features referred to were summarised as under :—Total capacity of the system was 186,450 KW., which was contained in 18 stations, of which four operated by means of coal firing ; three by coal firing and coke-oven gas ; three by waste heat from coke ovens ; and eight by exhaust steam from blowing engines, &c. The capacity of individual stations had increased from 2,400 to 50,000 KW., and the average capacity of boilers from 6,000 to 45,000 lb. Boiler pressure had risen from 120 to 270 lb., and the steam temperature from 350 to 675° F. Average capacity of machines increased from 267 to 10,000 KW., and the speed from 85 to 2,400 R.P.M. The steam consumption had decreased from 28·5 lb. to 10 lb. per KW.-hour. The KW. capacity per sq. ft. of area occupied had increased from 0·3 to 15 KW., and the KW. capacity per man engaged in operation from 141 to 633 KW. A discussion followed the reading of the paper, and Mr. Watson, in replying, said average cost of coal to the company had gone up by over 200 per cent., wages and other items had gone up by 145 per cent., but the average receipts, as a result of the extra costs incurred, had only increased by 54 per cent. He strongly advocated the development of waste-heat supplies.

South-Eastern Union of Scientific Societies.—The twenty-fifth annual Congress will be held at the Town Hall, Eastbourne, on June 2nd, 3rd, 4th and 5th. The proceedings mainly relate to biological and geological subjects, and include several visits to places of interest. The hon. general secretary is Mr. H. Norman Gray, 334, Commercial Road, London, E. 1.

Physical Society of London.—At the meeting held on April 23rd, 1920, the fourth Guthrie Lecture was delivered by M. Charles Edouard Guillaume, who lectured on "The Anomaly of the Nickel Iron Alloys : Its Causes and its Applications." He showed and explained curves showing the variation of magnetic properties, and of the coefficients in the expansion equation for alloys, and showed from the curves how it was possible to obtain alloys with any desired coefficient. The chief weakness of the alloys, from the point of view of the metrologist, was instability. With increasing carbon content the instability very rapidly increased. The curve connecting the instability and the carbon content passed through zero, showing that the instability was due to the carbon. It was, therefore, possible to get an invar of perfect stability. Among the applications to which invar had been put, the speaker instanced pendulum rods, leading-in wires for electric lamps (an alloy being chosen from the curves, so as to have the required coefficient of expansion, wire standards for base measurements in surveying, &c. Another important application of those alloys was in chronometer construction. The temperature coefficient of the rate of a watch was due to variation of the elasticity of the hair-spring. It was possible to compensate the elasticity variation over the whole range. Sir R. T. Glazebrook, in proposing a vote of thanks to the lecturer, said that it was largely to the work of M. Guillaume in the early days of the Bureau at Sèvres that they owed their knowledge of mercurial thermometry. The lecturer had illustrated the important connection between science and industry, and how, if that connection were to be strong and productive of the best results, it was necessary that scientific investigations should be carried out to their fullest extent. They had seen how, in the first place, the various physical properties of these steels had been examined, and how the results so obtained had subsequently been of the highest value in solving problems of great practical importance.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

At an investiture held in Newcastle by Prince Henry on 7th inst., Capt. L. E. MOLD, of Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne, was decorated with the O.B.E. (Military Division) for services in France.

On May 7th the staff engineers of the York Corporation electricity department held their first annual dinner at the New White Swan Hotel. In the unavoidable absence of the chief engineer, Mr. E. J. NICHOLS took the chair. After dinner a musical programme was given by Messrs. J. P. Wood, T. Gowland, E. J. Nichols, and other members of the staff. The chairman, on behalf of the staff, presented a suit case to Mr. E. M. Pearson, mains superintendent, who is about to take up a similar post at Stepney.

Mr. A. B. MUIRHEAD, who has been identified with the business of D. Selby Bigge & Co., consulting engineers, of 53, Bothwell Street, Glasgow, for 20 years, has become a partner in the firm, which will continue under the same title.

Mr. E. MORGAN, Assoc.M.Inst.C.E., A.M.I.E.E., who for the past ten years has served with the Yorkshire Electric Power Co. (latterly as operation engineer), has been appointed technical and engineering assistant to the chief engineer and general manager of the Wolverhampton Corporation electricity undertaking.

The salary of Mr. T. B. MOSELEY, chief clerk of the Bradford Corporation tramways department, has been increased from £400 to £425.

Weymouth T.C. has appointed Mr. G. NICHOLSON, assistant electrical engineer, as borough electrical engineer, at a salary of £500 a year, with free residence, the question of salary to be reconsidered at the end of six months.

Mr. H. ENGLAND, the convener of the Yorkshire and District Tramway Managers' Association, Leeds, was recently presented by the members with a silver rose bowl in recognition of services rendered to the Association since its formation in 1904.

Faversham T.C. has increased the salary of the electrical engineer (Mr. G. SOMMERVILLE) to £430 a year, plus £20 for special services rendered at the sewage works.

Whitehaven T.C. has increased the salary of the borough electrical engineer (Mr. HOGARTH) from £450 to £500.

It is proposed to increase the salaries of the Accrington Corporation electrical engineer and tramways manager respectively from £500 to £650 as from April 1st last, with an additional increase of £50 each from April 1st, 1921.

The *Times* states that General Sir Arthur William Currie, G.C.M.G., K.C.B., who formerly commanded the Canadian Corps in France, has been appointed Principal of McGill University, Montreal, in succession to the Rt. Hon. Sir Auckland Geddes.

Mr. E. S. BARRALET, who has been manager of Messrs. Pinchin, Johnson & Co.'s insulating varnish department for the last 18 years, has been appointed a director of the company.

The *Times* states that Dr. DEUTSCH, head of the A.E.G., arrived in Paris on Tuesday to take part in the forthcoming economic negotiations between German and French business men.

The Highways Committee of the L.C.C. recommends the following appointments in connection with the reorganisation of the Council's tramways department: Mr. J. R. WIGNAL to be principal technical assistant in the permanent way branch (as from August 1st, 1921); Mr. F. H. Wigner, senior technical assistant in the electrical branch; Messrs. A. W. Leach, F. Cook, J. J. Harding, and C. W. Fourniss, technical assistants, Grade II. in the rolling stock branch; Mr. E. H. Beal, technical assistant, Grade II. in the permanent way branch; Messrs. W. Press, C. E. Wheeler, and A. Pearce, technical assistants, Grade III. in the electrical branch; Mr. H. S. Sellar, motor school superintendent; Mr. A. F. Bentall, rolling stock inspector; and Mr. J. R. Walker, assistant power station engineer, to be inspecting engineer in the electrical branch.

Mr. C. C. VALDER has been appointed supplies manager of Messrs. Siemens Brothers & Co., Ltd. (Sheffield branch), 23, Filey Street, Sheffield. He has been employed with the firm since 1910, originally in the fittings department, and since demobilisation in the estimating department of the lamp and supplies department, Upper Thames Street, London, E.C. He served with the forces all through the war, and his military record was particularly good. In 1914 he was a sapper in the London Electrical Engineers, after which he was gazetted second lieutenant in the King's Own Royal Lancashire Regiment. Later he became captain in charge of Divisional Artillery Signals, and was eventually temporarily in command of the 66th Division Signal Company of the Royal Engineers from July, 1915, to June, 1919. While in this position he was awarded the M.C. for meritorious service at Landrecies.

NEW COMPANIES REGISTERED.

Dunblane and District Electricity Supply Co., Ltd. (11,193).—Private company. Registered in Edinburgh May 5th. Capital, £500 in £1 shares. To carry on the business indicated by the title. The first directors are: H. J. Osborn, Wynthorpe, Baxter Road, Sale, Cheshire, engineer; W. Sharp, Hillside of Keir, Dunblane, farmer. Registered office: 213, West George Street, Glasgow.

Falkesley Electrical and Kinema Supplies, Ltd. (167,214).—Private company. Registered May 7th. Capital, £5,000 in £1 shares. To take over the business of film renters, agents and producers, electrical contractors, patentees of a curtain controller, cinematograph agents, &c., carried on by F. E. Clipstone at Thurland Street, Nottingham. The first directors are: F. E. Clipstone, Highbury Avenue, Keyworth, Notts; S. H. Brown, J.P., 92, Noel Street, Nottingham; B. Smith, 7, Sussex Street, Nottingham. Qualification, £25. Solicitor: A. F. Neane, Burton Street, Nottingham. Registered office: 6, Thurland Street, Nottingham.

New Process Electric Lamp Co., Ltd. (167,268).—Private company. Registered May 8th. Capital, £5,000 in £1 shares (3,000 preference). To take over the business of electric lamp manufacturers and agents carried on by S. Coxon and W. A. Williams at Canning Place, Liverpool, under a similar title. The first directors are: S. Coxon, 20, Catton Avenue, Liverpool, electrical engineer; W. A. Williams, 56, Canterbury Road, Wallasey, Cheshire, electrical engineer. Solicitor: Eskrigge, Roby & Carr, 5, Cook Street, Liverpool.

Goodall Electric, Ltd. (167,261).—Private company. Registered May 8th. Capital, £2,000 in £1 shares. To take over the business of electricians carried on by T. J. Stapley, W. J. Mills and T. C. Jones at 17a, South Castle Street, Liverpool, as the "Standard Electric Co." The first directors are: L. Jackson, 47, Saxonia Road, Walton, Liverpool; T. R. M. Chetter, 64, County Road, Liverpool. Solicitor: E. B. Driffield, 20, Castle Street, Liverpool. Registered office: 64, County Road, Walton, Liverpool.

H. A. Bryce, Ltd. (167,372).—Private company. Registered May 12th. Capital, £5,000 in £1 shares. To take over the business of an electrical engineer carried on at 69, Middlewood Road, Sheffield, by Herbert A. Bryce. The first directors are: H. A. Bryce, 69, Middlewood Road, Hillsbrough, Sheffield, electrical and mechanical engineer; J. Enock, 3, Seaside Road, Sheffield, builder; J. R. Marsh, 1, Swaledale Road, Sheffield, electrical engineer. Registered office: 69, Middlewood Road, Hillsbrough, Sheffield.

Lester & Browne (London), Ltd. (167,288).—Private company. Registered May 10th. Capital, £5,000 in £1 shares. To carry on the business of manufacturers of and dealers in electrical accessories, apparatus and appliances, electrical, chemical and general engineers, &c. The first directors are: G. W. Lester, 71, Carlton Road, Tufnell Park, N.; G. E. Lea Wynne, 58, Hilldrop Crescent, N.7; E. H. Bonney, 11, Sunninghill Road, Lewisham, S.E. Solicitor: H. Borradaile, Old Serjeants' Inn Chambers, E.C. Registered office: 44 and 46, Surbiton Road, Kingston.

T. E. Slaughter & Co., Ltd. (167,338).—Private company. Registered May 11th. Capital, £7,500 in £1 shares. To take over the business of manufacturers of and dealers in "Lyto" dry cell and other electric batteries carried on by T. E. Slaughter and others at 172, Church Road, Mitcham. The first directors are: Mrs. E. A. Dollar, 13, Hyde Park Square, W.; W. H. Edridge, 24, St Mary Abbott's Terrace, W.14; T. E. Slaughter, 5, King's Road, Wimbledon, S.W.; E. E. G. Boite, 13, Portland Street, Cheltenham. Solicitors: Edridge, Son & Marten, 4, High Street, Croydon. Registered office: 172, Church Road, Mitcham, Surrey.

Taylor & Kay, Ltd. (167,339).—Private company. Registered May 11th. Capital, £2,000 in £1 shares. To carry on the business of manufacturers of lamp shades and electrical accessories, electrical engineers, &c. The subscribers (each with one share) are: W. M. Groom, 49, South Croxted Road, West Dulwich, S.E., surveyor; L. Wheeler-Taylor, 37, Essenedine Road, Maida Vale, W.9; H. Kay, 29, Colville Terrace, Bayswater, W., motor engineer. The first directors are: W. M. Groom, L. Wheeler-Taylor, H. Kay, H. E. Rainbow. Secretary: F. P. James. Registered office: 327, Edgware Road, W.

Western Anglo-Swedish Electric Welding Co., Ltd. (167,396).—Private company. Registered May 12th. Capital, £25,000 in £1 shares. To carry on the business of electric and other systems of welding, engineering, dealing in plant, machinery, ships, vessels and hardware, &c. The subscribers (each with one share) are: H. J. Richards, 133, The Exchange, Cardiff, consulting engineer; E. H. N. Moxon, 101, Leadenhall Street, E.C., shipbroker. The subscribers are to appoint the first directors. Solicitor: P. J. Nicholls, 17, Farringdon Street, E.C. Registered office: 25, Mount Stuart Square, Cardiff.

John Porter Engineering Co., Ltd. (167,411).—Private company. Registered May 13th. Capital, £10,000 in £1 shares. To take over the business of a general electrical and motor engineer carried on by J. Porter at North Shields. The permanent directors are: W. Lilburn, Netherton, Heaton Road, Newcastle; J. C. Patterson, 4, Churchill Gardens, Jesmond; J. H. Richardson, 37, Linskill Terrace, North Shields; J. Porter, 117, Chirton, West View, North Shields; A. Melrose, 22, Northumberland Square, North Shields; R. Saunders, 48, Park Crescent East, North Shields;; R. W. Stranghan, 155, Grey Street, North Shields. Solicitor: F. C. Chitt, 34, Grey Street, Newcastle-on-Tyne.

T. Emery's Automatic Power Generating Motors, Ltd. (167,337).—Registered May 11th. Capital, £10,000 in 5,000 preference shares of £1 each and 100,000 founders' shares of 1s. each. To take over from T. Emery certain inventions and patent rights, and to carry on the business of manufacturers of self-starting automatic power generating motors for power stations and factories, and for generating light and heat in public buildings, hotels, theatres, kinemas and private buildings, high-speed motors for trains and electrically-driven agricultural machinery, high-speed turbines for ships and battleships (instant reverse motion), motor cars, motor cycles and scooters, high-speed light motors for aeroplanes, timepieces, town clocks, watches, musical instruments, such as organs, gramophones and mechanical toys, &c. The memorandum of association as originally printed contained a clause as follows: "In view of the world-wide importance of Mr. Emery's inventions, the company shall have power to increase its capital to £25,000,000. Upon any such increase of capital such new shares shall be issued in the same terms, in the same proportions as the original share capital of the company." but this clause has been deleted and the deletion initialled by all the subscribers. Another extraordinary clause appears (*i.e.*, remains in) the articles of association, to the effect that Mr. T. Emery "intends to devote" not less than 50 per cent. of the net proceeds he receives by way of dividends "towards relieving the temporary distress that may result from the introduction of this invention, and any surplus to any other more needy and deserving cases, or education of the poor." The subscribers (each with one preference share) are: Dmitri Tchernine, 25, Windsor Court, Bayswater, W., journalist; W. T. C. Lock, "Totteridge," Temple Road, Epsom, director of companies; Major C. E. New, O.B.E., The Limes, Kingston Hill, Surrey; D. Jenkins, Bryntirrion, Aberporth, South Wales, shipowner; T. Emery, 26, Marsham Street, S.W., British and foreign patentee; W. W. Coltart, Tower House, Epsom, surgeon; S. C. Robertson, 14, Disraeli Gardens, Putney, S.W., engineer draughtsman. The first directors are: Dmitri Tchernine, W. T. C. Lock and T. Emery, all of whom are permanent. T. Emery is managing and technical director. Remuneration of T. Emery, £5,000 per annum; chairman, £2,500 per annum; ordinary directors, £1,000 per annum. The purchase consideration for the inventions is £5,000, payable wholly in founders' shares, of which the vendor directs 20,000 to be allotted to Mr. Cole Lock and 15,000 to the International Exchange and Banking Corporation, Ltd. The papers were filed by the last-named company. Solicitor: C. B. Lumley, 130, Strand, W.C. Registered office: 392, Strand, W.C.

B. Young & Co. (Birmingham), Ltd. (167,254).—Private company. Registered May 8th. Capital, £3,000 in £1 shares. To carry on the business of electrical and mechanical engineers, &c. The subscribers (each with one share) are: S. F. Outon, 1,246, Pershore Road, Stirchley, Birmingham, engineer; B. Young, Mignon Cottage, Jordan Road, Four Oaks, Warwick. B. Young is the first director. Registered office: 100, Leek Street, Birmingham.

British Electric Lamps, Ltd. (167,205).—Private company. Registered May 7th. Capital, £20,000 in £1 shares. To take over (1) the business of manufacturers of and dealers in electric lamps carried on by E. R. Grote at 173, Hartfield Road, Wimbledon, and (2) the business of manufacturers of and dealers in electric candles, lights and stoves carried on by the Lux Candle Co., Ltd. The first directors are: E. R. Grote, Lynwood, Church Lane, Merton, Surrey; A. A. Barren, Headlands, Berkhamsted (director, Lux Candle Co., Ltd.). Holders to be appointed by subscribers. Solicitor: E. A. Davidson, 2, Gresham Buildings, Basinghall Street, E.C. Registered office: Spencer Hill Road, Wimbledon, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

J. C. H. Martin, Ltd.—Equitable mortgage on The Bear Yard, dated April 29th, 1920, to secure all moneys due or to become due from company to Barclay's Bank, Ltd.

Thermo Electric, Ltd.—Sir Arthur F. Whinney, K.B.E., of 46, Fredericks Place, Old Jewry, E.C., as Receiver on April 29th, 1920, under powers contained in certain debentures.

Coatbridge and Airdrie Electric Supply Co., Ltd.—Charge on the company's undertaking and property, present and future, including uncalled capital and the Coatbridge and Airdrie undertakings, benefit or certain agreements, contracts, &c., dated December 20th, 1919 (supplemental to mortgage dated March 1st, 1904), to secure £7,000. Holders: County of London Electric Supply Co., Ltd.

Brompton and Kensington Electricity Supply Co., Ltd. (28,913).—Capital, £300,000 in 20,000 preference and 40,000 ordinary shares of £5 each. Return dated April 1st, 1920. 5,662 preference and 34,338 ordinary shares taken up. £195,000 paid on 5,662 preference and 33,338 ordinary. £5,000 considered as paid on 1,000 ordinary. Mortgages and charges, nil.

British L.M. Ericsson Manufacturing Co., Ltd. (79,061).—Return dated March 31st, 1920. Capital, £200,000 in £1 shares (99,990 preference and 100,010 ordinary). All shares taken up. £170,000 paid (being £1 per share on 50,010 ordinary and 99,990 preference and 8s. per share on 50,000 ordinary). £30,000 considered as paid on 50,000 shares (being 12s. per share). Mortgages and charges, £50,000.

Burgess Hill and District Electrical Supply Co., Ltd.—Return dated March 19th, 1920. Capital, £6,000 in £1 shares (3,000 ordinary and 3,000 preference). All shares taken up. £5,900 paid. £100 considered as paid. Mortgages and charges, £1,300.

City of London Electric Lighting Co., Ltd.—Return dated April 7th, 1920. Capital, £1,200,000 in £10 shares (80,000 ordinary and 40,000 preference). 70,595 ordinary and 40,000 preference shares taken up. £1,105,950 paid. Mortgages and charges, £800,000.

County of Durham Electrical Power Distribution Co., Ltd. (61,591).—Return dated March 30th, 1920. Capital, £425,000 in £1 shares. 400,000 shares taken up. £400,000 paid. Mortgages and charges, £250,000.

Kensington & Knightsbridge Electric Lighting Co., Ltd. (26,193).—Capital, £350,000 in 50,000 ordinary, 10,000 1st preference, and 10,000 2nd preference shares of £5 each. Return dated March 25th, 1920. 21,000 ordinary, 10,000 1st preference, and 10,000 2nd preference shares taken up. £179,840 paid on 15,968 ordinary, 10,000 1st preference, and 10,000 2nd preference. £25,160 considered as paid on 5,032 ordinary. Debt due from company in respect of mortgages and charges at date of return, £115,000; ditto guaranteed jointly by this company and Notting Hill Electric Lighting Co., Ltd., £225,000. Registered since date of return. Issue on April 13th of £25,000 debenture, part of a series already registered.

CITY NOTES.

Oriental Telephone and Electric Co., Ltd.

The gross earnings during 1919 were £124,648, plus £11,502 brought forward. Working expenses, maintenance, &c., absorbed £70,909; debenture interest and redemption charges have been provided for. The dividend on the ordinary shares is 10 per cent., and the bonus 2 per cent., both free of tax; £5,000 is put to general reserve; £2,000 to staff pension fund; and £11,013 carried forward. The operations of the branches and subsidiaries have continued to show increased revenues. The great obstacle to further expansion has been the difficulty in procuring supplies of material and their shipment to the East. An improvement in this direction is already apparent, with the result that it should soon be possible to overtake arrears and give facilities to intending subscribers whose names are now on the waiting lists. For this purpose several technical assistants were sent to the East during 1919. The reconstruction of the Singapore exchange building has been completed, and the new switchboard equipment is now being brought into use. At December 31st, 1919, the company had, in all, 8,020 exchange and private lines in operation, a net increase of 730. The following dividends have been declared by the Indian local companies, viz.: 18 per cent. by the

Bombay Telephone Co., Ltd., as against 16 per cent. for the year 1918; and 8 per cent. by the Bengal Telephone Co., Ltd., as against 7 per cent. At December 31st, 1919, the Bombay Co. had 7,880 exchange and private lines in operation, being a net addition of 880 during the year, and the Bengal Co. 6,846 exchange and private lines, being a net addition of 547. The gross revenue of the China and Japan Telephone & Electric Co., Ltd., has been increased, but the net result of the working is rather less favourable than that of the previous year on account of the high price of material and labour and the adverse effect of the continued rise in exchange. At December 31st, 1919, the company had 5,575 exchange and private lines in operation, a net addition of 804. The previous rate of dividend, viz., 10 per cent., free of income tax, has been maintained. The liquidation of the Telephone Co. of Egypt, Ltd., has not yet been completed. A distribution of £29,632 announced by the liquidator on December 24th, 1919, and the receipt by this company of that sum on January 1st, 1920, has enabled a further amount of 2s. 6d. per share to be distributed as capital amongst the ordinary shareholders, and the capital reserve account has thus been reduced to £173,464 since the close of 1919.

General Electric Co. (U.S.A.).

The report of this company for 1919 shows that the value of the orders received was $237,623,932, as compared with $234,134,037 for 1918. For some months succeeding the armistice, the volume of business booked was much curtailed; but during the last eight months of the year orders steadily and rapidly increased, so that the present demand for the company's products is greatly in excess of the capacity of its factories. At the close of the year the amount of orders unfilled was $98,880,000, compared with $80,000,000 at the end of 1918. The great increase in orders for all classes of apparatus manufactured by the company makes it necessary to add substantially to its manufacturing capacity. This is being accomplished partly by enlarging its present plants and in part by purchasing, or leasing with option to purchase, factories already constructed which offer immediately available facilities, thus enabling the company to secure an earlier output than would be possible by erecting and equipping new factories of like capacity. The total factory floor space has been increased from 19,581,000 sq. ft. in 1918 to 20,681,000 sq. ft. in 1919.

The company has for several years been engaged, in its research laboratories and factories, in the development and manufacture of apparatus and devices essential to the transmission and reception of wireless communications. Its inventions have had a far reaching effect on the entire radio art. The Marconi Wireless Telegraph Co. of America is also the owner of valuable patents, rights, and licences, and it has seemed wise to the boards of directors of both companies that their research and engineering resources should hereafter be used in closest co-operation. To this end, and in order to secure the benefits of the long and varied electrical manufacturing expereince of the General Co. on the one hand, and the operating experience of the Marconi Co. on the other, a new company has been formed, known as the Radio Corporation of America, in which both the G.E. Co. and the Marconi Co. have accepted a considerable participation.

In the report of the company for the year ending December 31st, 1918, reference was made to the incorporation of the International General Electric Co., Inc., for the purpose of taking over the assets, investments, and activities of the company in foreign countries, covering manufacturing, selling, engineering, utility enterprises, &c. In accordance with that announcement the company subscribed for the entire capital stock of the International General Electric Co., Inc., consisting of $10,000,000 of 7 per cent. preferred stock at par and $10,000,000 of common stock at 110, paying therefor the sum of $21,000,000 cash (part before December 31st, 1919, and the balance in January, 1920), and sold to the International General Electric Co., Inc., securities and accounts of like value.

The widespread and diversified interests involved have prevented the completion, at December 31st, 1919, of all of the transfers and therefore this report combines, for the sake of convenience, the assets and liabilities of the International Co. with those of this company.

The Swedish Ericsson Co.

The report for 1919 of the directors of the Allmänna Telefon Aktiebolog L. M. Ericsson states that the reserve which was manifested on the cessation of the war continued during a large part of last year, and the demand for manufactures only increased in the second half, when orders arrived in greater abundance. As a result of the keen competition in the world's markets, it was impossible to keep sale prices on the level demanded by the high costs of production in Sweden. The company had orders on hand at the beginning of 1920 for 10,000,000 kr., and orders had been plentiful since, whilst in the matter of prices the changed conditions in the most important foreign labour markets seemed recently to have reduced the difficulties of the Swedish export industries to some extent. Work at the Stockholm shops proceeded without disputes during the year, the number employed there having risen from 1,296 to 1,359 at the end of the year; and a total bonus of 1,146,000 kr. was paid to the personnel to meet the increased cost of living. The value of the deliveries from the workshops amounted to 15,770,000 kr., as compared with 12,750,000 kr. in 1918; 10,840,000 kr., or 68.7 per cent. of the former represented exports, as against 7,550,000 kr. and 59.2 per cent. in 1918.

A new subsidiary company had been formed in Holland which, together with the Dutch colonies, had become one of the company's principal markets in recent years. The largest customers were composed of State and municipal authorities, who had set up a strong demand that at least some of the telephone material should be manufactured in the country, having regard to the increased purchases which were being made. In order to meet this demand the directors accepted an offer made by a competitive undertaking in Holland to take over the business, and for this purpose a Dutch company was constituted with the Swedish company holding the majority of the share capital. The decision to this effect was reached last autumn, but the business was only taken over at the beginning of 1920. The factory could not occupy more than 150 workmen, but it would be able advantageously to carry out some of the work which formerly involved high freight and Customs charges, and good possibilities existed for its future extension. Coming to consider the South American markets, the report mentions that the importance of sales there had considerably increased during the war, and the directors considered that the markets ought to be worked in a more direct and energetic manner than could be done through local agents. For this purpose a branch was established in the middle of last year at Buenos Ayres with the object partly of carrying on direct sales, and partly of undertaking the construction of telephone installations and acquiring telephone concessions. During the short time of its existence the branch had not been able to show big results, but judging from everything South America would become a specially good market for the company's manufactures. The activity of the branch had hitherto been limited to Argentina and Uruguay, but the intention was also to cover the remainder of South America, particularly Chile and Brazil.

After dealing with the subsidiary companies in Petrograd, London, Austria, Hungary, Buffalo, U.S., Paris, and Finland, the report returns the net profits at 3,750,000 kr., as against 3,740,000 kr. in 1918. The directors recommend a dividend at the rate of 5 per cent., this contrasting with 6 per cent. in the previous year, when the share capital participating was 61,500,000 kr., as compared with 73,250,000 kr. at the end of 1919.

The Austrian Cable Works and Wire Industry Co.

The directors of the Kabelfabrik und Drahtindustrie A.G., of Vienna, reporting on the year 1919, state that it was only possible partly to utilise the capacity of the works, as was also the case in recent years; raw materials were more difficult to obtain owing to the separation of the individual States in Customs and transport matters, and even some departments had temporarily to cease working altogether. At the end of the year the stocks in Vienna showed an increase as compared with the close of 1918, as it had been possible for the company to acquire various materials in connection with the demobilisation, for which payment was made in war loan, which was also utilised for the payment of the war tax. Relatively favourable results were obtained both by the Zoptau & Stefan Mining & Ironworks Co., and the Corinthian Iron & Steel Works Co. The authority given a year ago to raise the share capital to 10,000,000 kr. by the issue of 9,000 shares of 200 kr. was exercised in January, 1920, and the result of the issue, through which the company's own funds were increased by approximately 9,000,000 kr., would be brought into the accounts for the new financial year. After writing off 986,000 kr. for depreciation, the net profits are returned at 3,815,000 kr., which sum is reduced to 3,606,000 kr. by a payment made to the Pressburg Cable Works Co. under the joint profit equalisation contract between the two companies. The balance forward from 1918 brings the total amount available for disposal to 4,005,000 kr., and the dividend is at the rate of 18 per cent., or 36 kr. per share, on a share capital of 8,200,000 kr.

Arbroath Electric Light & Power Co., Ltd.—The profits for the year amounted to £3,628, plus £484 brought forward. The directors recommend a dividend of 7 per cent. on the ordinary shares, which carries an increase of 1 per cent. on preference shares. The year was a prosperous one for the company. A large number of new consumers have been connected up within the last few months, and at the present time the demand is greater than the present installation can supply. It will be necessary to lay down additional mains before next winter, and further engine power and other plant will also be required soon. The expenditure will necessarily be heavy, but the prospects are excellent, and it is proposed by the directors to increase the capital to £100,000, divided into 10,000 £1 5 per cent. preference shares, participating up to 6 per cent., and 90,000 £1 ordinary shares.

Lancashire Dynamo & Motor Co., Ltd.—Dividend 10 per cent. on the ordinary shares, tax free.

West India & Panama Telegraph Co., Ltd.—Interim dividends were paid in November last on the first and second preference shares at 6s. per share, leaving £10,033, which the directors think should be carried forward to the current year's account. According to the *Financial Times* the year 1919 was the most disastrous in the company's history, the primary cause being the unprecedentedly long delay of the cable-steamer, the *Henry Holmes*, at Trinidad in undergoing her third survey. In the first three months of this year the loss of traffic is estimated at £18,000. Every effort has been made to obtain the services of cable-steamers of other telegraph companies, and on three occasions the efforts were successful, but for short periods only. An opportunity having recently offered, it was decided, notwithstanding the expense, to charter a cable-steamer for five months, and it is hoped in that time to restore several, if not all, of the most important sections.

Stock Exchange Notices.—Application has been made to the Committee to allow the following to be officially quoted:—

English Electric Co., Ltd.—1,431,509 ordinary shares of £1 each, fully paid (Nos. 1 to 1,431,509); and 552,528 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 1 to 552,528), and £1,000,000 5½ per cent. sinking fund first mortgage debentures.

Submarine Cables Trust.—4,200 coupons of reversion (Nos. 1 to 4,200).

The Committee has specially allowed dealings in the following under temporary regulation 4 (3):—

Callender's Cable & Construction Co., Ltd.—400,000 ordinary shares of £1 each, fully paid (Nos. 1 to 400,000); and 400,000 6½ per cent. cumulative preference shares of £1 each, fully paid (Nos. 1 to 400,000).

Greenwood & Batley, Ltd.—96,000 7 per cent. cumulative preference shares of £1 each, fully paid (Nos. 1 to 96,000); 168,000 ordinary shares of £1 each, fully paid (Nos. 1 to 168,000); and 174,195 new ordinary shares of £1 each, fully paid (Nos. 180,391 to 354,585).

Para Electric Railways & Lighting Co., Ltd.—5,000 6 per cent. cumulative preference shares of £1 each, fully paid, (Nos. 320,001 to 325,000).

The Committee has ordered the undermentioned to be officially quoted:—

Para Electric Railways & Lighting Co., Ltd.—5,000 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 320,001 to 325,000).

West London & Provincial Electric Supply Co., Ltd.—Mr. H. Kahn presided at the annual meeting last week. He said that the balance at profit and loss of the West London showed an increase of £1,151 over that of last year, chiefly due to the fact that they received 7½ per cent. dividend on their shares in the Chiswick Corporation, as against 6 per cent. last year. Out of £4,716 available for distribution, they proposed to pay a dividend on the cumulative preference shares of 6 per cent., less tax, and the interest in arrear for the years 1914, 1915, and 1916 of 4½ per cent. per annum on the funding certificates, the balance of £251 being carried forward. He had reason to hope that, barring unforeseen circumstances, this time next year they would be able to wipe out the remaining arrears of interest on the funding certificates. The results both at Chiswick and Aberystwyth had shown an improvement. The outlook for the year 1920 seemed quite good, in view of the results already obtained, but, naturally, with the uncertainty of prices both for fuel and labour, it would not be safe to be to optimistic.

Altrincham Electric Supply Co., Ltd.—A dividend of 7 per cent. per annum on the ordinary shares is announced.

Submersible Motors, Ltd.—Mr. B. T. Rumble presided at the annual meeting held at Southall on May 12th. He said it was not possible to lay the accounts before the meeting as they were being audited. The negotiations with the Admiralty as to prices had been completed, and the meeting would be adjourned until the amount of the company's liability for excess profits was known. In the meantime an interim dividend of 5 per cent. for the year ended March, 1919, was being paid. In the fire of November last they lost the whole of the records of the work in progress in the shops at the time. Until the whole of the amount of the loss on all items was known the insurance companies refused to deal with any part of the claim.

Prospectus.—*Aster Engineering Co. (1913), Ltd.*—This company is offering for subscription (May 28th is the closing day) 100,000 8 per cent. cumulative participating preference shares of £1 each at par. The capital is being increased to provide funds for the purpose of additions which are now being made to the existing works and equipment for the execution of the increasing volume of profitable business. Over 30,000 Aster engines are already in use, and many of them have been at work for 12 to 15 years; a considerable and increasing business is now growing up in the manufacture of spare parts and renewals.

Fellows Magneto Co., Ltd.—The report for 1919 states that; after allowing £4,615 for depreciation, &c., there is a net profit of £22,644. The 8 per cent. dividend on the cumulative participating preferred shares for 1918 has been paid, absorbing £9,255. The directors recommend a participating dividend at the rate of 1½ per cent. per annum, less tax, on the preferred shares, making 9½ per cent. for 1919, and a dividend of 25 per cent., less tax, on the ordinary shares. £5,772 is to be carried forward, subject to excess profits tax.

Tramways (M.E.T.) Omnibus Co., Ltd.—According to the *Financial Times*, the accounts for 1919 show that, after providing for the service of the debenture stock and for income tax, &c., and including £15,000 transferred from reserve, the credit balance of £1,055 brought forward is converted into a debit of £7,265.

Rhondda Tramways Co., Ltd.—Dividend 8 per cent., less tax, on the preference shares on account of arrears (from 1914 onwards); £8,000 to reserve and renewals; £25,694 for repairs and maintenance; £1,280 carried forward.

Loughrea, Co. Galway, Electric Power & Lighting Co.—Dividend at the rate of 5 per cent., free of tax, for the past year.

Submarine Cables Trust, Ltd.—The report for the year ended April 15th, 1920, states that the revenue amounted to £26,259 and the expenses to £1,820, leaving a balance of £24,438. After providing £12,372 to meet payment of the coupons, the sum of £12,066 has been transferred to the redemption fund; £66 is carried forward.

Puebla Tramway, Light & Power Co.—A meeting of holders of the first mortgage 35 year 5 per cent. gold bonds is called for June 15th, in London, to consider proposed modification of their rights.

Dudley, Stourbridge & District Electric Traction Co., Ltd.—Dividend of 4 per cent. on the ordinary shares for 1919. £1,000 to reserve; £2,000 to renewals; £65 carried forward.

Johnson & Phillips, Ltd.—The financial Press states that the recent issue of 87,500 £1 ordinary shares was largely oversubscribed.

Siemens Bros. & Co., Ltd.—Final dividend of 1s. per share, free of tax, making a total dividend of 10 per cent. per annum, free of tax, for 1919.

Oldham, Ashton & Hyde Electric Tramway, Ltd.—Dividend of 6 per cent. for the year 1919 on the ordinary shares.

Nairobi Electric Power & Lighting Co., Ltd.—Final dividend of 2 per cent., making 10 per cent. for 1919.

STOCKS AND SHARES.

Tuesday Evening.

The course of the Stock Exchange markets never runs smoothly when politics interfere with it. The Chancellor of the Exchequer is accused of not knowing his own mind sufficiently to make him definite on the point of what taxation shall be imposed, and what dropped. Flirtation with the question of a War Wealth Levy is one of the factors which make, at the present time, for hesitation and uncertainty in the Stock Exchange markets. The effect of this is felt all round. The man of wealth, not knowing where he is to be attacked, sells a little stock by way of precaution. The Stock Exchange man, fearing that War Wealth taxation will bring a lot more securities to market, puts down prices in case this may happen. The whole of the House is affected by these considerations, while amongst industrials, the outlook is darkened by the new difficulties which seem likely to spring up in Labour circles as one result of the rise in coal.

Electricity Supply shares are heavy by reason of this latter cause. Charing Cross, City Lights, Westminster, Kensington and County of London ordinary shares are down ½ to ¼. The preference shares remain unchanged. Amongst manufacturing issues the same tendency prevails. Electric Constructions and Cromptons are both lower. In the cable group, Henley's lost 1/16. Elsewhere, Castner Kellner developed flatness on selling from the North, and the price dropped to 3¾.

Eastern Extensions and Eastern Telegraph ordinary are quoted ex dividend, and the former at 15 offer a yield to 6¾ per cent., dividends being paid free of tax. A Bill giving the U.S. Secretary of State the right to license all cables landing on American shores has been introduced at Washington. Its sponsor claims that American cable communications with South America were being hampered by a Brazilian grant of exclusive rights to an English company to operate cables in its territory. The Stock Exchange market views the matter without concern. Oriental Telephones have eased off to 2¾; the dividend is raised from 10 per cent. to 12 per cent., tax free, of which 2 per cent. is declared by way of bonus. West India and Panama ordinary have fallen to 12s. 6d., and both classes of preference weakened. The recent report is not relished. Marconis went back to 3 before rallying to 3¼. Marconi Marines are flat at 37s. 6d.

Urban Electric preference were not immediately affected by the passing of the dividend, as mentioned here last week, but shares came to market later on at 22s. 6d., at which price they were taken. The ordinary are quoted about 6s., and could perhaps be bought for rather less. Edmundson's ordinary stand at the same level, and the 6 per cent. preference last changed hands at 43s. 1½d. These, like the Urban preference, are of the nominal value of £5, and are fully paid. The ordinary of both companies are £3 shares, also fully paid. River Plate Electricity ordinary stands at 105 ex dividend and bonus. Victoria Falls preference are better at 20s., the 5 per cent. first debentures are 94½, and the Seconds 102¾, while the ordinary, in which there is not much market, stand at 12s. English Electrics remain fairly steady at 20s. 9d. British Aluminium new ordinary are a pound, General Electric new ordinary 29s. 6d., the 7½ per cent. B preference 19s. 3d., and the 6½ per cent. preference have gone back to 17s. 6d.

The Underground Railway group is weak because of the unsettlement—up to the time of writing—amongst the omnibus men. Central London preferred at 45½ is 2 lower. Of other traction issues, Mexicans have improved, on the assumption that any Government other than that of Carranza might make an agreeable change from the chaotic conditions prevailing under his régime. Bombay Electric preference have started to mount again, and are 15s. up at 13¼. Brisbane

Electric Tramways 4½ per cent. debenture stock is quoted higher at 94. Under the Trust Deed the stock becomes repayable at 100 on January 1st next, and a full year's interest will have become due by then. This would look a "dead-snip" for the investor were it not for the lurking doubt as to the redemption being carried out at due date.

Metropolitan-Vickers ordinary are firmer at 27s. 6d., and the preference retain their last week's advance at 25/16. Armament and engineering shares show a dwindling tendency. A fall of 2s. 6d. lowered Babcock & Wilcox to 2¼. The rubber market went down sharply in company with the raw material, but recovery from the worst ensued.

Before the war, one of the best reference books available in connection with electric lighting and traction was Atkin's "Manual," privately published by a well-known Stock Exchange firm for circulation amongst their friends and fellow-members. The volume has made a welcome reappearance, and is a power-house of information. How up to date it is may be exemplified by the details of the British Electric Transformer's new issue of 137,500 7 per cent. preference (at 17s. 6d.) and 162,500 ordinary shares (at 24s.) made last month. The English Electric Company's figures for 1919, which were announced in April, are duly shown, the ordinary receiving 8 per cent. dividend, £100,000 going to capital reserve account, £133,045 expenses written off, and £45,301 being carried forward. Mention is made of the General Electric's offer, in March last, of 400,000 new ordinary at 28s. and £1,600,000 new 7½ per cent. B preference shares at 20s., existing holders being offered at the same time the right to subscribe for one new ordinary share at 28s. in the proportion of one new for every three old shares held. The "Manual" is in other respects fully up to date, and is admirably produced.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1918.	Dividend 1919.	Price May 18, 1920.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	8	12	6½	—	£9 8 2
Charing Cross Ordinary	4	7	9½	— ½	9 6 8
do. do. do 4½ Pref.	4½	4½	2½	—	8 8 8
Chelsea	3	4	3	—	6 3 4
City of London	8	10	11½	— ½	8 12 0
do. do. 6 per cent. Pref.	6	6	9	—	6 18 4
County of London	7	8	8½	— ½	9 2 10
do do. 6 per cent. Pref.	6	6	8¾	—	6 17 2
Kensington Ordinary	6	7	4½	— ½	7 11 5
London Electric	Nil	2½	1¾	—	5 3 6
do. do. 6 per cent. Pref.	6	6	8½	—	9 4 8
Metropolitan	5	6	3	—	10 0 0
do. 4½ per cent. Pref.	4½	4½	2½	—	8 0 0
St. James' and Pall Mall	10	12	6½	—	8 16 10
South London	5	6	2¾	—	9 12 0
South Metropolitan Pref.	7	7	18/9	—	7 0 0
Westminster Ordinary	8	10	5	— ½	10 0 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	77½	—	7 14 10
do. Def.	83/8	1½	18½	—	8 0 0
Chile Telephone	5	6	6½	—	*4 18 2
Cuba Sub. Ord.	7	7	9½	—	*7 7 4
Eastern Extension	8	10	15xd	—	*8 13 4
Eastern Tel. Ord.	8	10	153¼xd	—	*6 10 4
Globe Tel. and T. Ord.	8	10	15½	—	*6 7 0
do. do. Pref.	6	6	8½	—	7 1 2
Great Northern Tel.	22	—	21½	— 1	9 15 8
Indo-European	18	10	40	—	6 5 0
Marconi	25	—	8¾	— ½	6 0 0
Oriental Telephone Ord.	10	12	9½	— ⅛	*4 11 5
United R. Plate Tel.	6	—	7x	— x	*5 5 0
West India and Panama	1/8	—	⅛	— ⅛	-
Western Telegraph	8	10	15½	—	*6 7 0
Home Rails.					
Central London Ord. Assented	4	4	4½	—	8 19 9
Metropolitan	1	1½	19½	— ½	0 8 2
do. District	Nil	Nil	15¾	—1½	Nil
Underground Electric Ordinary	Nil	Nil	1⅞	— ⅛	Nil
do. do. "A"	Nil	Nil	4 6	—9d.	Nil
do. do. Income	5	4	60½	- 3	6 12 3
Foreign Trams.					
Anglo-Arg. Trams. First Pref.	Nil	Nil	5½	—	—
do. do. 2nd Pref.	—	—	2	—	—
do. do. 5 Deb.	5	•5	57¼	—	8 18 10
Brazil Tractions	—	—	49½	— ½	—
Bombay Electric Pref.	6	6	13½	+ ½	4 11 3
British Columbia Elec. Rly. Pfce.	5	5	55½	—	9 2 9
do. do. Preferrred	2½	5	48½	—	10 6 2
do. do. Deferred	Nil	3	44½	—	6 14 10
do. do. Deb.	4½	4½	52	—	8 3 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	28½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	20	—	Nil
Mexican Light Common	Nil	Nil	12½	—	Nil
do. Pref.	Nil	Nil	2¼	+5	Nil
do. 1st Bonds	Nil	Nil	29	+3	—
Manufacturing Companies.					
Babcock & Wilcox	15	—	2⅞	— ½	*5 4 4
British Aluminium Ord.	10	10	1 13/16	—	9 8 2
British Insulated Ord.	12½	15	1 15/16	—	7 14 8
Callenders	25	—	8	—	7 16 8
do. 6½ Pref.	6½	6½	6¾	—	6 16 10
Castner Kellner	20	—	9¾	— ½	—
Crompton Ord.	10	—	21/6	— 6d.	9 6 0
Edison-Swan, "A"	10	—	1¾	—	8 17 10
do. do. 5 per cent. Deb.	5	5	79½	—	6 5 9
Electric Construction	10	—	21/-	—1/-	9 10 6
Gen. Elec. Pref.	6½	6½	17/6	—	7 8 7
do. Ord.	10	—	1¾	—	*6 3 1
Henley	25	15	2 1/16	— 1/16	7 5 3
do. 4½ Pref.	4½	4½	5¼	—	6 18 6
India-Rubber	10	—	13½	—	*7 11 0
Met.-Vickers Pref.	—	8	2 1/16	—	6 18 6
Siemens Ord.	10	10	20 0	—	*7 11 0
Telegraph Con.	20	20	22½	—	*5 6 8

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, May 18th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per lb.	2/10	...
a Ammoniac Sal ... ... per ton	£100	...
a Ammonia, Muriate (large crystal) ,,	£62	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£42	...
a Copper Sulphate ... ... ,,	£49	£3 dec.
a Potash, Chlorate ... ... per lb.	1/-	...
a ,, Perchlorate ... ... ,,	1/3	...
a Shellac ... ... per cwt.	£24	...
a Sulphate of Magnesia ... ... per ton	£18	...
a Sulphur, Sublimed Flowers ... ,,	£28	...
a ,, Lump ... ... ,,	£25	...
a Soda, Chlorate ... ... per lb.	6d.	...
a ,, Crystals ... ... per ton	£13	...
a Sodium Bichromate, casks ... per lb.	...	...
METALS, &c.		
g Babbitt's Metal Ingots ... ... per ton	£118 to £345	...
c Brass (rolled metal 3" to 12" basis) per lb.	1/9½	...
c ,, Tubes (solid drawn) ... ... ,,	1/6½ to 1/6¾	...
c ,, Wire, basis ... ... ,,	1/8⅜	...
c Copper Tubes (solid drawn) ... ,,	1/8½	...
g ,, Bars (best selected) ... per ton	£165	£2 inc.
g ,, Sheet ... ... ,,	£165	£3 inc.
g ,, Rod ... ... ,,	£165	£2 inc.
d ,, (Electrolytic) Bars ... ... ,,	£114	...
d ,, ,, Sheets ... ,,	£156	...
d ,, ,, Wire Rods ... ,,	£129	...
d ,, ,, H.C. Wire ... per lb.	1/4½	...
f Ebonite Rod ... ... ,,	8/-	...
f ,, Sheet ... ... ,,	2/6	...
n German Silver Wire ... ... ,,	3/-	...
A Gutta-percha, fine ... ... ,,	13/-	...
A India-rubber, Para fine ... ... ,,	2/3	½d. dec.
i Iron Pig (Cleveland Warrants) ... per ton	Nom.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£57	...
g Lead, English Pig ... ... ,,	£40 to £41	...
g Mercury ... ... per bot.	£23 to £25	...
e Mica (in original cases) small ... per lb.	6d. to 4/6	...
e ,, ,, ,, medium ... ,,	5/- to 10/-	...
e ,, ,, ,, large ... ,,	12/6 to 25/- & up	...
g Phosphor Bronze, plain castings ,,	1/7 to 1/11	...
g ,, ,, rolled bars and rods ,,	2/2 to 2/6	...
g ,, ,, rolled strip & sheet ,,	2/3 to 2/9	...
d Silicium Bronze Wire ... ... per lb.	1/11½	...
r Steel, Magnet, in bars ... ... ,,	1/8	...
g Tin, Block (English) ... ... per ton	£284	£38 to £39 dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	6/3	...
White Anti-friction Metals ... per ton	£90 to £345	...

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
A Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Electric Furnaces. — Mr. C. H. Booth describes in *Canadian Machinery* a new type of cylindrical rotating arc furnace of moderate size for dealing with brass and other non-ferrous metals, for which the advantages are claimed of even distribution of heat with consequent long furnace life and low loss of zinc by vaporisation. The furnace, which is made in sizes from 250 to 3,000 lb. capacity, consists of a lined cylindrical body with horizontal axis resting on rollers driven through gearing by an electric motor. The two electrodes project through water-cooled apertures in the end plates and the single-phase supply is taken to them by contact rings on the rotating body. Hand regulation is used in the smaller sizes, but the largest furnaces are fitted with automatic gear. The lining is cleverly contrived with as few joints as possible, and can be renewed without much difficulty. The charging door at the end of the furnace is hinged like the breech-block of a gun and swings back with the electrode in its centre and all the electrode gear. Before pouring, the furnace is stopped with the tap hole at the top, when it is opened by picking out the sand plug with a pointed tool, and the furnace is slowly rotated until the metal begins to pour. The movement can be controlled to a nicety due to the electrical drive. Thirty to forty minutes are required to melt a charge, and with a small furnace the energy consumption is about 300 KW.-hours per ton. From 600 to 1,000 heats are believed to be obtainable without relining, and the electrode consumption in a 250-lb. furnace, fairly constantly employed, averages 31 lb. per ton.

A novel device described in the *Iron Age* is a tilting mechanism for removing a furnace roof when charging. The furnace, as constructed by the Industrial Electric Co., Chicago, is mounted upon rocker-arms, and the roof is suspended from a frame which is tilted by a rack and pinion. All electrical connections are under the platform of the furnace. The motors for controlling the electrodes are mounted on the back of the roof frame. When the roof is tilted back the most bulky scrap can be dropped directly into the furnace as cold stock, pre-heated scrap, or melted metal. The furnaces are built in 2, 4, and 7-ton capacities, and are arranged for two or three-phase current.—*Technical Review.*

PERMANENT MAGNETS IN THEORY AND PRACTICE.

By S. EVERSHED, M.I.E.E.

[*Résumé of paper read before the* Institution of Electrical Engineers.]

Referring to the difficulty of compressing the paper, which represented the work of 20 years, into the time available, the author made no attempt to read it, but delivered an exceedingly interesting lecture on its contents, of which the following is an outline :—

Ampère suggested that the magnetism of a permanent magnet was due to electric currents flowing in molecular circuits; this hypothesis was now accepted, and Ewing's theory of the interactions between neighbouring magnetic molecules with its aid fully explained the phenomena of the cyclic curve of magnetisation. The electron theory showed how the Ampère elements were constituted, consisting of a system of electrons moving with very high velocity in orbits round a nucleus; the existence of the molecular currents would be assumed, but for simplicity the molecule with its system of electronic currents would be represented by an imaginary circuit or "current ring," carrying a permanent and constant current, and behaving magnetically like the actual molecule. It was assumed that the rings were immersed in the universal magnetic medium of space.

Magnetisation of iron was effected by turning the molecules so as to co-operate, by the application of an extraneous magnetic field, which applied an orienting torque to the current rings (it did not "magnetise" anything). On removing the applied field, the mass of current rings was left in a more or less oriented condition, defined by their orientation angle θ. The magnetised iron would now possess an inherent magnetomotive force F in the direction of the field, the oriented mass of rings creating induction in that direction.

Ohm's law held good in the magnetic as in the electric circuit. An electric current could be changed by changing the resistance in the circuit, or by making an addition to the electromotive force. In a short-circuited battery of electromotive force E and resistance R the current $I_1 = E/R$—here called the "self-absorbed" condition. If now an external inert resistance r were added to the circuit (an "extended" circuit), the current would be decreased, requiring less E.M.F. to maintain it in the original resistance R, and setting free a surplus motive force which, when equilibrium was restored, would just suffice to maintain the diminished current in the external resistance r, so that $I_2 = E/(R + r)$, or if $V = I_2 r$, $E = I_2 R + V$. Or the current may be equally diminished by inserting an opposing E.M.F. e in the circuit, when $I_2 = (E - e)/R$ or $E = I_2 R + e$. It would be seen that $V = e$, or the opposing motive force applied to the self-absorbed circuit to produce the same change must be numerically equal to the surplus motive force set free in the extended circuit, but of opposite sign.

The statement was equally true for complete magnetic circuits, whether containing iron or not, because in the magnetic medium there was strict proportionality between motive force and flux. On the hypothesis of molecular currents and one universal magnetic medium, the word "permeability" ceased to have any meaning. The author showed that, as in the case of the electric circuits, so in a magnetic circuit the flux could be diminished either by extending the circuit, or by applying an extraneous motive force in the negative direction without altering the circuit. In the former case (extended circuit) he obtained the numerical relation $F = \beta + \phi$ where F = inherent magnetomotive force per cm., β = the magnetic induction, and ϕ = the surplus magnetomotive force not required to maintain the flux in the magnetised body itself. In the latter case (self-absorbed circuit) he obtained $F = B + H$, where H was the extraneously applied motive force, and B was the resultant flux density, due to the combined action of F and H per cm. If R were chosen so that $B = \beta$, and F the same in both cases, it followed that $\phi = H$; for equal change in the magnetic flux, the positive surplus motive force per cm. of steel in the extended circuit was numerically equal to the negative extraneous motive force per cm. of steel applied to the self-absorbed circuit.

After showing, on the basis of known and assumed electronic data, that the electron theory would fully account for the magnetomotive force inherent in iron (which was equivalent to a magnetising force of 17,000 ampere-turns per cm.), the author proceeded to discuss the design and predetermination of permanent magnets. The function of these, he said, was to maintain magnetic energy in some particular space such as an air-gap. The primitive equations were, for terminal flux, $B = \beta A$, and for terminal potential difference $V = \phi L$. The magnetic energy was BV. To predetermine the characteristics of a magnet it was first necessary to determine the B H curve of demagnetisation of the steel. A typical curve for tungsten magnet steel was shown (fig. 1) in which B = flux density, and H the extraneously applied motive force per cm., to which ϕ, the surplus motive force, was numerically equal. Neglecting leakage, and denoting the length and sectional area of the core by L and A respectively, the relations between the factors of energy B and V and the dimensions of the magnet were $B = \beta A$ and $V = \phi L$. Any flux density β might be chosen, and by making $A = B/\beta$, the core would deliver the desired terminal flux; and if the corresponding value of ϕ were taken, by making $L = V/\phi$, the required terminal potential difference would be provided. But if economy of steel or of space were aimed at, such haphazard design would not serve. The energy requirement must be taken into account. The energy equation was obtained by multiplying the two primitive equations together, $BV = \beta\phi LA$, where BV was the amount of energy maintained in external space by a volume of steel L A in which the flux density had the value β. The product $\beta\phi$ was the available or useful energy per cubic cm. of magnetised steel. The volume of steel $= BV/\beta\phi$ so that to use the least volume of steel, $\beta\phi$ must be a maximum. Its value might be plotted against flux density, as shown on fig. 1, on the right, and the maximum value was then seen at a glance, giving at once the "economic density." The economic dimensions of the magnet core could then be determined by inserting the values of β and ϕ in the primitive equations.

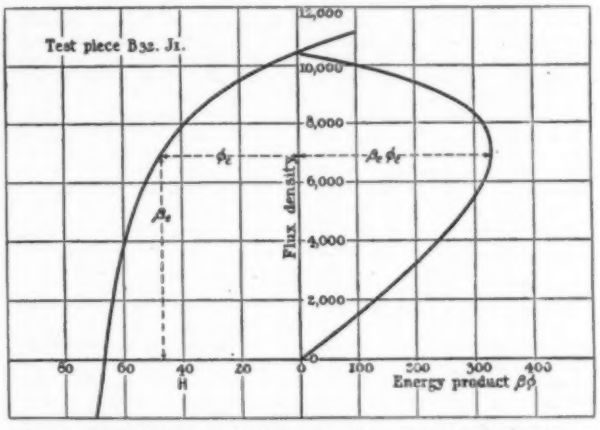


Fig. 1.—Typical demagnetisation curve for magnet steel, showing the derived curve of the energy product $\beta\phi$. N.B.—Numbers on the energy scale when multiplied by $1000/8\pi$ give the energy in ergs.

The author then dealt with the question of leakage, and showed how the formulæ could be applied to the design of economic magnets and the predetermination of their performance, giving examples which showed that a very high degree of accuracy was attainable. In the course of a summary of the paper he said :—

Throughout the paper the underlying purpose has been to gain a clearer view of fundamental matters and to build up a theory of the permanent magnet consistent with present-day knowledge, and readily applicable to the practical problems of design and predetermination.

The gathering together of molecules of equal magnetic moment into concentrated groups need not be regarded as the sole possible mode of departure from uniformity which will endow the mass with the necessary power to form local bonds of mutual induction. Any kind of molecular *variformity* which, in effect, brought about an unequal distribution of the molecular magnetomotive forces, would give rise to a similar state of things. And in view of the increased ability to maintain itself in a partially-oriented state, which iron exhibits when carbon and other non-magnetic substances have been introduced, it seems by no means unlikely that the necessary departure from uniformity may consist in the congregation, in one mass of equally-spaced molecules possessing unequal magnetic moments; some stronger, some weaker, than the average. As a limiting case, we may imagine the presence of non-magnetic molecules distributed throughout a mass of magnetic molecules. Such an arrangement would provide magnetically vacant spaces for the propagation of local fields of mutual induction, in much the same way as the concentrated groups which we have taken as a simple example of variformity.

As a corollary to Ewing's theory, the hypothesis of molecular variformity appears to be necessary to account for the facts of permanent magnetism.

Discussion in London.

Mr. H. B. Atkinson opened the discussion, and described the excellent paper as the result of 25 years' work on the part of the author. It would rank as a classic with those papers presented by Hopkinson and Kapp in 1886; it was a monumental work. The paper contained the first clear statement on the subject that had been put before the electrical world. The author's method of predetermination for the purpose of the design of magnets was one that could be used by engineers. The trouble to-day, he thought, was that engineers were not thinking sufficiently in terms of electrons, of electron currents. With regard to the author's statement that the "energy of an electric current being kinetic, any two or more current rings will tend to turn on their pivotal axes in directions which will increase their joint energy" he thought that only held if the energy was maintained constant by external means. Again, the statement that the "energy of the mass will be increased if any two or more rings turn

round until they possess a magnetic axis in common" was erroneous; on the contrary, the energy would diminish, in his opinion, 50 per cent. Those statements of the author referred to what would happen only if the currents in the coils were maintained constant by an external battery and not under other conditions. With regard to the predetermination of a ring magnet by step-by-step integration, the author in this way obtained a number of corresponding values of width of air gap and terminal flux, but the late Dr. S. P. Thompson had shown experimentally that no change in flux whatever accompanied variation of the air gap. These matters were referred to in the tenth Kelvin lecture delivered by the speaker last year. However, the speaker thought that the author's reasoning was correct, and would help greatly to clear up many doubtful points. Both the author's and his own theories, he felt, were correct mathematically, but some change in the interior mechanism of the author's was necessary so that it would conform with experimental facts.

Dr. G. Kapp complimented the author on the extremely able manner in which he had prepared his paper. Their object, he thought, should be to strive to help the steel maker; to tell him how to vary the constituents or the treatment of his materials so that he could produce the desired material. In the early days wrought iron was specified for dynamo magnets, but to-day he thought that Sheffield could say that it had produced cast steel which would give equal, if not better, results than iron. He thought it very desirable to formulate a theory that was capable of being put into everyday phraseology, so that they could give the steel-maker the information he required. Further information about the iron-cobalt-carbon-chromium steel mentioned in the paper would be very welcome.

Major K. Edgcumbe thought they were indebted to the author for giving them a classic paper which contained much information of which they had long been in need. They would now be able to deal with iron magnets as easily as they could with coils, but his opinion was that the predetermination of the qualities of a magnet and its design should be kept separate. The author's apparent object of obtaining the maximum possible energy from a minimum volume of steel was good, but was he sure that that method would give the desired permanency? There were two forms of permanency; first, for magnets used in such devices as magnetos, &c.; and secondly, for instrument magnets. The former magnets had to withstand a good deal of vibration, &c., and it was not of much consequence if their total flux decreased slightly, but with the latter type of magnet it was a serious matter if the flux varied by more than 1 per cent. With regard to symbols, some of those used in the paper did not meet with the speaker's approval. Some of them were in exact opposition to those selected by the International Electrotechnical Commission after a great deal of labour, and it was to be regretted that the author had struck out on his own instead of falling into line and adopting the standardised symbols.

Prof. E. W. Marchant said that the paper very clearly explained the position of the subject under discussion. It gave promise of much improvement in magnetic materials. The fact that the atomic weights of all strongly magnetic materials were very nearly the same was of much interest. Some substances, such as maganese and silicon, had the power of destroying magnetism, but could not produce it themselves. The atomic weights of non-magnetic substances differed appreciably from those of magnetic materials, and it would be of much interest to know whether any relationship existed between them. The paper raised hopes of obtaining the required steels by means of heat treatment, or by altering the molecular structure, the tribal arrangement as the author termed it, of the material. The author had shown them how to look at the subject from a new point of view which would be of extreme value.

Mr. H. M. Dowsett, whose remarks were illustrated by lantern slides, said that the very determined effort the author had made to build up a consistent theory of magnetism proceeding step by step from the inter-atomic electron ring to the commercial permanent magnet, would be welcomed by everyone who desired to see physics and engineering practice brought into one consistent scheme of evolutionary development. The weak link in the chain was the character of the inter-atomic electron current, which depended on the structure they postulated for the atom. In order to endow the atom with magnetism it was necessary to assume that the electrons were rotating rings, and were themselves magnetic. Some years ago he attempted to construct an atomic model which would satisfy the requirements of the physicist and of the chemist, and yet would be subject to the gravitational and electrodynamical laws. The principal obstacle in the way was the physicists' assumption, as the result of many experiments, that the total number of electrons in the atom could not very much exceed the number representing its relative atomic weight in the periodic series of the elements, and that the positive charge whose constitution and place in the atomic structure they knew nothing about, must, therefore, be credited with practically the whole mass of the atom. If the whole mass of the atom could be said to be due to the united masses of the electrons—as was at first assumed by J. J. Thomson—and the positive charge and the balance of the electrons above the atomic number could be so arranged in the atom as to be practically insensitive to most means of experimental research, that difficulty would be removed. Proceeding on these lines, the speaker said he had devised a model, which he illustrated by lantern slides, which was able to act electrically, chemically, and radioactively in a manner which could satisfactorily explain experimental results. His present object was to show that it was possible to devise a simple type of atom which conformed to the laws of electrodynamics, and also afforded a reasonable basis for a complete theory of magnetism which would start with the constitutional movement of the electrons in the atom.

Mr. A. P. Young, in congratulating the author on his work, said that they had imagined that they had discovered something new when during the past five years they began to plot betaphi curves in order to judge the quality of magnet steels, and to apply the product curve to the design of a permanent magnet. The author, however, told them that he had first used the method 18 years ago, which showed how far behind they had been. It was curious that although an alloy of three parts iron to one part nickel produced a non-magnetic metal, when heated to a temperature of 1,000 deg. and cooled in air the substance immediately became magnetic. He had recently heard that an American claim was that the permanent flux was improved by magnetising the material at a temperature of 200 deg. below zero. Another interesting metal was the cobalt steel mentioned by the author. The paper would cause them to think about the why and wherefore of such effects as he had mentioned; they had been given a lead, and good results would follow. In the future they needed to think more in terms of the atom when seeking solutions to their difficulties.

Dr. E. H. Rayner said that the paper raised again the question, what was the basis of the characteristic of ferro-magnetism? The modern conception of the atom was a planetary system of electrons, each possessing a charge of negative electricity, gyrating round a central positive system. The number, and perhaps arrangement, of electrons was directly associated with the atomic weight; and, therefore, with the characteristics of the atom, and gave each element its particular properties. In the general case such a system, if the electronic orbits of a single atom were arranged indefinitely in space, would exhibit no magnetic polarity. In order to exhibit polarity there must be more or less concentration of the motion of the electrons into one direction such as existed in the solar system, all circulating roughly in one plane, or at least on the surfaces of something like cylinders. An atom, or system of atoms, which possessed a polarisation of such a type, would in general have its external field largely neutralised by neighbouring ones, as they would tend to line up so as to produce a closed field. In order to exhibit polarity in the mass, it would appear necessary that, under the influence of an external field, for instance, the motion of the individual electrons in large numbers of atoms must be induced to rotate about axes more or less parallel. It was possible that in many atoms there was some particular constraint, associated with the distribution of electronic motion, which prevented the action of an external field producing this orderliness of motion necessary for the production of general magnetic polarisation. Such bodies would be non-magnetic. This would also be the case if, in spite of orderliness being part of the nature of the electronic motion in the atom, the constraint were due to the arrangement of the molecular or larger aggregation. There remained the crux of the problem, if such ideas corresponded to anything approaching the structure of the atom, how to explain why iron was almost unique in its properties. The electronic theory differentiated atoms of the various elements largely by the number of electrons in the atom. If they had a system of N^3 electrons, or electronic systems, it was possible to arrange such a number of electrons in very simple symmetrical systems, which might be illustrated by the corners of a cube which had 2^3 corners, or by the sides of an octahedron which had 2^3 sides. A similar symmetry was obtainable if they had $m \times 2^3$ systems. The atomic weight of iron was about 5 6, or 7×2^3, and it might be that this chance possibility of a peculiar symmetry endowed the atom and its agglomerates with the properties of ferro-magnetic bodies. There was also a peculiar symmetry associated with the number 7. For instance, a regular hexagon was formed by one central point and six surrounding it at equal distances from the centre and from each other. Such a system might be regarded as composed of six equilateral triangles, and such a figure in one plane could only be formed by a 7-point type of symmetry. The other elements which exhibited magnetic properties, and which, alone, or associated with certain other elements, as in the case of manganese in the Heusler alloys, were all very close to 56 in atomic weight as Prof. Marchant had stated. The four, manganese, iron, nickel, and cobalt lay between 55 and 59, while there was a relatively large jump to chronium 52 below, and to copper 63 above, both of which were non-magnetic. If they assumed that electronic number distribution determined atomic properties, including magnetism, then it would appear that atomic weight, which was associated with electronic number, must govern such things as magnetic properties, and magnetic properties must be the result of something dependent upon number and probably upon a peculiar symmetry associated with number.

Colonel R. E. B. Crompton, C.B., welcomed the paper as an epoch-making one, and said it reminded him of the old days. The discussion would not end that night; the paper would continue to be discussed by electrical engineers the world over for some considerable time to come. It had given him keen delight to send copies of the paper across the water to Dr. Steinmetz and others, to show them that they were still capable of doing things in this country. He, however, wished the author had adopted a different course with regard to the symbols he had used. There was no reason why he should have selected a new set when there already existed an international set.

Mr. S. Evershed, in his reply, said it was impossible to reply to the discussion in the time at his disposal, and he, therefore, reserved his full reply for publication in the Institution *Journal*. He would feel that his work had not been in vain if the paper, as Mr. Young had said, would start other men thinking, and lead to something being done. It was not permissible to discuss the Kelvin lectures, and they had, therefore, not had the opportunity of pointing out the fallacy in Mr. Atkinson's argument. With his theory it was difficult to see how there would be any magnetism at all, and there would certainly be no permanent magnetism whatever. The speaker felt that there must have been something wrong with Dr. S. P. Thompson's experiment mentioned by Mr. Atkinson. The flux variations were so small that unless the experiment were made with extraordinary accuracy they were liable to escape notice. Finally, the author defended the use of his own set of symbols in preference to the international ones selected by the International Electrotechnical Commission.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Trading Restrictions.

Referring to a letter headed as above and signed "Interested," which appeared in your issue of the 30th ult., I have pleasure in sending herewith replies to the writer's questions:—

1. Can any contractor stock, advertise, or sell lamps which are not controlled by his Association? (Viz., E.L.M.A.)

Yes, excepting as provided for in answer to the second question.

2. Can any graded retailer stock, advertise, or sell metal filament lamps of any other than Association makes?

A graded retailer agrees not to advertise, stock, or solicit orders for lamps of non-Association make in return for special discounts over and above trade terms, but may sell such lamps on demand.

The writer quotes the following clause from a retailer's agreement:—

"We agree not to advertise, stock, or solicit orders for metal-filament lamps of any type or group of other than Association makes (as set out in previous page)."

This clause means exactly what it says. A graded retailer may supply non-Association lamps in fulfilment of an order received by him, but in consideration of special terms agrees not to push the sale of other than Association lamps. If a contractor wishes to reserve the right to advertise, stock, or solicit orders for non-Association lamps then he can do this and still buy Association lamps at ordinary trade terms.

J. E. Edgecombe,
Director,
Electric Lamp Manufacturers' Association of Great Britain, Ltd.

London, E.C.
May 11th, 1920.

City of York Advertisements.

With reference to the York advertisement and the comments in your issue of May 7th, I am glad to see that someone has raised the question of salaries of staff engineers, and I am quite in agreement with your correspondents. As they state, present salaries are a poor return for time and money spent in technical training.

The manual workers are in a much better relative position, because years ago they realised the value of co-operation. Individual effort, however praiseworthy, is not much use. The Electrical Power Engineers' Association has for the past two years done its best to improve the status of staff engineers, and has at last secured consideration of our claims.

Should this letter come to the notice of staff engineers who are not members, I would ask them seriously to consider whether they wish to go on taking benefits for which they have not worked, and towards the attainment of which they have not contributed? Association means strength. Remember the bundle of sticks.

Join the Association now. Work for it. Don't be content until every available man in your station is a member.

Sic Itur.

Emergency Braking.

A short while ago, there appeared in your "Correspondence" columns a series of letters dealing with the emergency braking of an electric street car.

If the mechanical and magnetic brakes had failed, and by some means such as a section breaker opening or the trolley leaving the wire, and thereby cutting the line current off, it was necessary to stop the car, one would proceed by opening the main switch, placing the reversing lever of the controller in the reverse position, and feeding up to the first parallel notch. This method will, without a doubt, stop the car, assuming that both motors are working.

But supposing that previously there had been a defective motor, and that it had been "cut-out" in the controller, then the braking effect would be nil. For it will be seen that when both motors are in operation they are acting as generators, and as such they are revolving in opposite directions, and they will, through the medium of a controller, tend to pull each other up, thus giving a powerful electric braking effect. But when there is only one motor working, and the other is electrically cut out, there will be no effect. I have tested this method on a car equipped with Westinghouse type T.I.C. controllers and Westinghouse type 323 motors.

It would be exceedingly interesting if someone could suggest a method of stopping a car assuming the above conditions.

C. E. Slack.

Chesterfield.
May 13th, 1920.

Battery Symbols.

Surely "Eau Delun" (Electrical Review, May 14th), on second thoughts, will realise that his reference to "the negative (zinc) as the element having no standing" casts an undeserved slur on an *element* which not only is *positive*, but is, in truth, the fuel, and to a certain extent the veritable source of the cell's energy, in generating which, it (the zinc) is gradually consumed.

The very same energy which, in circuit tracing, is referred to as leaving the battery at the *carbon* or *copper* or *positive pole*, is due to the self-sacrifice of the *zinc*.

Outside the cell, the *carbon* or *positive pole* gets all the credit for the *zinc* or *negative pole's* hard work. However, for simplicity in circuit tracing, it is advisable that this somewhat paradoxical convention be adhered to.

This reminds me of a tragic episode long ago in the late seventies, before inspiriting *theory* had—in certain quarters—been to any great extent called in to vitalise stolid *practice*.

What in these days would be described as a frantic S.O.S. once reached me from a distant official. He had been ordered by H.Q. to make some tests with a fair number of Leclanché cells sent out for the purpose—a class of battery he had never before seen, his previous experience having been confined to Minottos—a kind of Sawdust Daniell, a cell of the "constant" type.

In those days, when Minottos were set up, it was customary to use water with which to soak the sawdust; the necessary sulphate of zinc in solution being subsequently obtained by the simple process of short-circuiting the battery on itself for something like 24 hours.

Our friend having set up the Leclanchés, had straightway short-circuited them, and, 24 hours later, was mystified and aghast to find that the zincs had melted into airy nothingness. They had vanished.

E. R. B.

The Policy of the E.P.E.A.

May we be allowed the hospitality of your columns to refer to the published statement of policy during contemporary industrial disputes issued by this Association in February, 1919.

The National Executive Council of the Electrical Power Engineers' Association in December last unanimously agreed to rescind this policy because of its incompatibility with the other functions of the E.P.E.A. as a protective organisation.

Considerable misunderstanding is arising on account of the prevailing impression that this policy is still being adhered to by the Association, and in order to remove the misapprehension, we take this opportunity of notifying its rescission.

W. Arthur Jones,
General Secretary,
Electrical Power Engineers' Association.

London, W.C.
May 18th, 1920.

[The statement of policy was published in our issue of February 28th, 1919, p. 231.—Eds. Elec. Rev.]

Electricity on the Farm.—A Spalding farmer, Mr. F. W. Farrow, has had plans of cottages for his workpeople approved by the Ministry of Health, and 40 cottages are to be built forthwith on bungalow lines. According to the daily Press, telephones are to be installed in each house, which are also to be electrically equipped throughout.

A VISIT TO LOUGHBOROUGH TECHNICAL COLLEGE AND THE BRUSH WORKS.

The members of the South Midland Centre of the Institution of Electrical Engineers were very fortunate in their choice of a day for their visit to the Technical College and the Brush Electrical Engineering Co.'s works at Loughborough last week. About ninety availed themselves of the opportunity, and the bulk of these came by motor omnibus from Birmingham, a four hours' journey. The main party arrived at the college shortly after 11 a.m., and the tour of inspection commenced at about 11.50. Small detachments of about eight visitors were put under the guidance of various members of the staff, who, with the greatest courtesy, replied to the various questions fired at them practically continuously. The first section of the college which came under notice was the cabinet-making department. Here, in what was originally a chapel, some beautiful work was being turned out by a number of ex-service men, who showed by actual results that at least one educational scheme was of great practical value. In one bay of this building one caught sight of a splendidly-finished bookcase, and a great variety of other furniture stamped with the hall-mark of good material and workmanship—dressing-tables, wardrobes, and bedsteads—also called forth admiration from the visitors.

Leaving the building, the party had to traverse a street or two to reach the next department. (Owing to the central position of the institute extensions cannot be made to the main building, and in consequence several other buildings within a short distance of the body of the college have been taken over.) This was the first of the machine shops, and the main item of interest was the gear shaping and cutting work being done there. The smithy was next visited, and a demonstration given on a pneumatic hammer in the centre of the shop. The three forges were hard at work, and the shop, although small, had a remarkably efficient appearance. Upon entering the heavy lathe shop the most noticeable features were a large variable-speed lathe, and another upon which hand-wheels were being turned up. The visitors were shown some good examples of elliptical collars and eccentrics in steel and brass made upon the latter machine. The next room to be seen was the automatic grinding and polishing department, where eight or nine machines were running. In the next shop, where screws were being manufactured, the party inspected some highly finished machine vices of very sound and accurate construction, and the guide stated that a large contract for these vices was being executed for Messrs. Alfred Herbert, Ltd. Every screw turned out is thoroughly tried on a special testing device, indicating by means of a pointer on a dial any inaccuracy in the thread. Welding by the electric arc, and also by oxy-acetylene apparatus was being carried out in the welding shop. The electrode in use was a silica-asbestos covered soft iron wire with a fine thread of aluminium incorporated. In the heat-engine testing shop the party were shown a six-cylinder optical indicator in course of construction, with which indicator diagrams will be taken simultaneously from six cylinders by means of a tube and diaphragm arrangement oscillating a small mirror which projects a beam upon a photographic plate. A demonstration of the principles involved was made upon a single-cylinder J.A.P. motor. A Daimler and an 80-h.p. Le Rhone aero engine were started up for the visitors' benefit, which left them rather deafened. Resistance and gas furnaces were then inspected, and the party next entered the X-rays room, where photographs of inspected work were exhibited. One or two sound-looking joints were shown to the party, and when the rays were applied the way in which the joints had been patched up was very forcibly brought out. Some very beautiful and costly photomicrographic apparatus was seen in the next department, and in the same room samples of iron were being subjected to heating and cooling tests by means of a small resistance furnace, a thermo-couple, and a temperature indicating mirror scale. As the allotted time had then reached its conclusion the party was forced to terminate the inspection, and passing through a nicely appointed students' reading-room, arrived at the dining hall at 1.30 p.m., where luncheon was efficiently served by the kitchen staff.

Dr. Garrard, on behalf of the members of the South Midland Centre, rendered thanks to the Principal for his hospitality and for the opportunity given to members of seeing such a splendidly equipped institute, remarking that it was not his first visit to the college.

Mr. Roger T. Smith (President I.E.E.), in seconding Dr. Garrard's vote of thanks, said that he would extend it by offering the appreciation of not only the South Midland Centre but of the whole Institution.

Responding to the vote, Mr. H. Schofield, M.B.E., explained that the enterprise was started with a great deal of misgiving as to its success, but he was glad to say that it had more than justified its existence. The college, he said, was based on an American idea of bringing education and experience into closer contact, and followed the lines of similar institutions at Worcester (Massachusetts) and Cincinnati. The greatest proof of its practical value was afforded by the fact that engineers, men who knew the kind of training required, were sending their sons and other relatives to Loughborough. The usual complete course was for five years, but a shorter course of three years, had also been arranged. The college had been organised on a commercial basis, and all products were sold at prevailing market prices, and contracts had been entered into with several firms for the supply of the articles manufactured.

Mr. W. A. Brockington, education officer of the Leicestershire County Council, endorsed the Principal's remarks, and said that the County Council educational authorities looked with great pride upon their "child." It then being nearly 2.30, the party had to leave rather hurriedly in order to commence the second part of its visit punctually.

Upon arriving at the Brush works the party was met by members of the company's staff, and was again split up into detachments, and the inspection commenced right away, it being explained that there was a great deal to see in a very short space of time. The works cover a large area, and consequently the inspection had to be carried out at a fairly quick pace, which at times made one wish that it had been possible to allot a greater time to the visit. The first shop entered was the winding department, where was seen the construction of many sizes and types of stators and rotors in various stages of progress. Some of the most interesting features presented to the party in this department were coils, &c., of the largest Ljungstrom turbine-driven generator constructed by the company up to the present time. This is being built to the order of the Midland Electric Corporation, Ltd., and is to have a capacity of 8,000 k.v.a. at 7,500 volts (.6 power factor). It is of the two-phase type, designed to run at a speed of 3,000 r.p.m. Here was also seen a single-phase alternator from the works of the Uxbridge & District Electric Supply Co., which was being rewound for three-phase. The power used in the works is supplied by the municipal authorities of Loughborough, whose supply is 220 volts, three-wire d.c., and so it is necessary to employ a number of machines to convert the supply to meet the needs of the Brush Co. for testing purposes, &c. In the winding shop the party was shown a motor-generator set which is used to test and dry out the coils of every machine before leaving the works. Each phase is tested separately before the machine is assembled. The rotor coils shown to the party consisted of alternate windings of bare copper and copper strip insulated with mica, and impregnated "Empire" cloth. The coils of the stator are made up and completely insulated before being placed in position, and they are wound so as to give the smallest possible potential difference between any pair of conductors. The visitors upon leaving the winding department were taken to a machine shop where the smaller parts of the Ljungstrom turbine were in process of manufacture. Here there were a number of vertical lathes, which were stated to be some of the best in the country. One of the products of this department is the gland fitted to the turbine shaft to prevent the escape of steam. This consists of concentric rings, in which the vents are so small as to permit the escape of only a negligible amount. In the turbine shop, which was next visited, the party was shown the manufacture and assembly of the blades. Lengths of channel-shaped steel strip are passed over drums and ground to a very thin size before being cut into suitable lengths. The rings into which the blades are fitted are mounted on an automatic punching machine, which prepares them for the reception of the blades. The latter are then fitted by hand through a soft metal strip, and are thus supported while being placed in position in the outer rings. When the top cover is fixed, these soft metal supports are sheared out. The cover plates when fitted are cut out in the centre, and are then used for the smaller stages of the turbine—this effects a great economy in metal. A seventeen-stage turbine was on view in this shop, the inner stages of which were arranged axially, and the final stage, catching the exhaust steam, was radial. The heavy machine shop came next on the route, and here the visitors saw the rotors, which are solid forgings, being turned up and slotted ready for the windings. The turbine casings are also machined in this department, and one of the time-saving devices shown to the party was a Lancashire Dynamo Co.'s "quick return" planing machine. The casting being operated upon required three small cuts at distances of from two to three feet. Travelling slowly over the surface of the cut the bed was released at a high speed, falling to low speed again at the next cut. When the third cut had been made the bed reversed and quickly returned to its starting point. The testing department, at one end of the shop, where the machines are mounted on a platform above a standard condenser, has a capacity for the rial of two 1,500-kw. sets, and arrangements are being made for the accommodation of the larger sizes. At this end of the shop were the turbines of a twin-screw vessel undergoing final adjustment. The tramway-car and omnibus department was then visited, and the advancing stages of construction were explained. One outstanding feature of the work inspected was the great amount of bent wood in use which was turned out in splendid condition. In one part of this shop the vehicles were being wired in an early stage of construction which, although a great advantage in many respects, gave an impression of inaccessibility in the case of the development of a fault.

Among the many vehicles undergoing finishing touches were cars for Birmingham and other Midland towns. There were also two or three of the latest type of L.G.O.C. 'bus with wide bodies and side rails in lieu of straps. The last department to be visited was the transformer shop, where various points of interest were noted. The largest transformer in hand was a 6,250-K.V.A., 3-phase type. The highest voltage transformer previously made by the Brush Co. had a pressure of 75,000 volts, but one at present under construction will be capable of dealing with 150,000 volts. The largest contracts for transformers in hand for use with rotary converters are 32,000 K.V.A. in 38 units, for the B.T.H. Co., and 21,259 K.V.A. in 24 units, for the G.E. Co. An order for 48 standard transformers, with a total capacity of 24,000 K.V.A., is being executed for the Yorkshire E.P. Co. In addition to winding, testing, &c., the company also makes the cases for its transformers, two old-type "guillotines" being used for corrugating the sheet iron which is built up and welded at the joints by oxy-acetylene apparatus.

Upon the conclusion of the tour of inspection, the visitors sat down to a "high tea," provided by the management, and votes of thanks were accorded to the Brush Co. for a very enjoyable and instructive afternoon. The party left the works for Birmingham at about 6 o'clock.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Annual Report.

The annual report of the Council of the Institution for the year 1919-20 shows that the membership at April 1st, 1920, amounted to 8,017, a net increase of 994 on last year's figure; it consisted of nine Hon. Members, 1,587 Members, 4,172 Associate Members, 620 Graduates, 1,152 Students, and 447 Associates. One hon. member, Prof. Hendrik Antoon Lorentz, of Leyden University, Holland, was elected during the year.

The military honours and distinctions arising out of the war that have been awarded to members during the year numbered 171.

The death of 55 members during the year is to be deplored, of whom nine laid down their lives on naval or military service. A service in memory of the members of the engineering profession who gave their lives in the war was held at Westminster Abbey on June 18th, 1918. The number of dependents of fallen members whose circumstances would warrant assistance from the War Memorial Fund is negligible, with the result that a larger proportion of the amount subscribed will be available for a suitable memorial in the Institution building. The book of biographies and portraits of members who gave their lives in the war is in active preparation.

Owing to the limited number of vacancies reported, the Electrical Appointments Board has decided that, for the present, members who have served in H.M. Forces shall continue to receive primary consideration.

On December 31st, 1919, the capital account of the Benevolent Fund of the Institution stood at £5,709, and the accumulated income at £1,750. The donations and subscriptions to the fund in 1919 amounted to £537. In the course of the year 24 grants were made, amounting to £291.

On behalf of the Institution the Council has accepted a benefaction from a donor who desires to remain anonymous during his lifetime; it consists of the transfer to trustees for the Institution, as a thank-offering to God for mercies vouchsafed to the donor during the war, of a sum of £2,000 5 per cent. War Loan stock on the following terms: The interest on the stock to be applied in such a way as the Council in its uncontrolled discretion may think fit (*a*) in the first place, to assist the education of one, or more, of those of our countrymen, not being a conscript, who has served overseas during the great war, and who is anxious to enter the profession of electrical engineering, and (*b*) in the second place, and subject thereto, to promote general electrical research.

The Council has rescinded the suspension of the associate membership examination rules, and in future, unless otherwise exempt, candidates will be required to pass the examination. In the case of applicants who have attained the age of 35, the Council may in its discretion dispense with the examination and the thesis.

Arrangements are being made for a deputation of the Council to wait on H.M. Commissioner of Works to urge the necessity for early reinstatement in the Institution building. The return of the Institution to its own premises will compel special reconsideration of financial provision for the future, and some increase in the subscriptions may have to be proposed.

During the year 67 books and pamphlets were presented to the reference library by members and others. The lending library is available to those who wish to borrow books, and during the year 667 books were issued to 300 borrowers, the corresponding figures in the previous year being 497 and 205 respectively. The catalogue is under revision. A number of valuable acquisitions have been made to the museum during the year, notably from the laboratory of the late Sir William Crooks, O.M.

The ordinary meetings held in London have been well attended; 17 ordinary, 18 Council, and 121 committee meetings were held during the year. The papers read during the session numbered 32, and 17 lectures were delivered at territorial and sub-centres, besides which five papers not read at meetings were published in the Institution *Journal*.

During the session the president visited each of the territorial and sub-centres in Great Britain, and also the sub-centres at Liverpool and Sheffield. Sub-centres were formed at Aberdeen, Dundee, Liverpool, Preston, Loughborough, and Sheffield. The meetings held by territorial centres numbered 35, and those held by sub-centres 23.

The Wireless Section of the Institution was formed in the spring of 1918; it has held eight meetings, at which the average attendance was over 140. The Council has drawn up rules for conducting the business of the section, which come into operation at the beginning of next session.

The Informal Meetings Committee has reported satisfactorily; eight meetings were held at which the attendance ranged up to 80, and a successful smoking concert was held in March, 1919. The meetings are now held fortnightly.

Since the armistice the Students' Sections have shown considerably increased activity, and a new Students' Section has been formed in connection with the Liverpool Sub-centre. The total number of Students' meetings was 27, in addition to a number of visits to works.

The scholarships awarded by the Council included three David Hughes, three Salomons, and one Paul scholarships, all tenable for one year, the former being of the value of £50, and the latter of £25. This is the first occasion on which effect has been given to the Council's decision to extend the scope of the David Hughes and Salomons scholarships by opening them to students in the provinces.

A local centre of the Institution has been established for Argentina, with headquarters at Buenos Aires.

The National Electrical Proving House Committee's report has been considered by the Board of Trade, and in the summary of the Government's proposals published in August, 1919, the matter was referred to as follows: "It is proposed to set up at the Board of Trade a Department of Standards, (1) to promote and co-ordinate standardisation generally, and (2) to establish and administer such testing institutions as may be found necessary, and authorise and, so far as may be required, supervise the testing work carried out by technical institutions, trade organisations, or private concerns."

The efforts of the Institution Patents Committee to obtain certain improvements in the patent law were continued in association with other institutions in connection with the passing through Parliament of the new law (Patents and Designs Act, 1919), with the effect that certain modifications were made, but on the whole the result was disappointing.

During the session several deputations representative of electricity supply, and organised by the Institution, were received by the Controller of Coal Mines with regard to coal prices and supplies, and giving to the consumer the benefit of the rebate on coal used for domestic purposes. From the point of view of electricity supply stations the question of coal prices and supplies is still on a very unsatisfactory basis, and the Council is to make further representations to the Government departments interested.

The committee appointed to report on regulations for overhead power lines (excluding tramway working conductors) will shortly present its first report to the Council.

The Civil Engineers' Registration Bill, promoted by the Institution of Civil Engineers, received the attention of the Council and of a special committee during the period under review. It is not the intention of the Institution of Civil Engineers to proceed with the Bill in the present session of Parliament.

The heavy cost of publication has prevented the publication of valuable matters which would otherwise have appeared in the *Journal*. With the object of making the *Journal* of the greatest value to the members a Committee of the Council has under consideration the question of its future form, and whether with a view to economy it should be divided into sections of interest to various groups and circulated accordingly.

The Council has decided to undertake a complete revision of the wiring rules. The committee has been strengthened by an additional representative of the Electrical Contractors' Association and by a representative of the Association of Supervising Electricians.

The regulations for the electrical equipment of ships were published in September, 1919, and were favourably received.

Lloyd's Register of Shipping is to issue a new set of electrical regulations for work done under its survey, and has embodied in them the Institution's regulations. During the year one meeting was held of the Standing Sub-committee, when an important discussion took place on the status of sea-going electricians, with the result that the Council communicated the following resolution to the Board of Trade: "That in view of the growth in the use of electrical power on ships, it would be desirable that the Board of Trade should consider the advisability of holding examinations and granting certificates to duly qualified electricians on sea-going ships." The Council also expressed willingness to prepare an examination scheme, if required.

During the past year a large expansion has taken place in

the work of the electrical section of the British Engineering Standards Association. Considerable progress has been made with many matters of great importance to the electrical industry. The closest posible co-operation with the Electrical Research Committee is assured, and some of the B.E.S.A. panels have taken steps in conjunction with that committee to inaugurate the necessary research work, particularly with practice of radiography.

The organisation of the Electrical Research Committee is now nearly complete. The researches already in hand have been brought into full activity, and a comprehensive programme for the future has been prepared. The researches initiated by the Institution are being continued under the control of the Committee, and arrangements are in hand for a rapid extension of programme.

The draft memorandum and articles of association of the proposed Society of Radiographers have been approved by the Board of Trade. The principal objects of the society are to ensure that only adequately trained radiographers are employed in electromedical work, and to promote the science and practice of radiography.

The Council was asked by the Ministry of Munitions in 1916 to nominate a representative of the Institution to serve upon the Nitrogen Products Committee. The Institution's representative was appointed chairman of the Power Sub-committee of the Nitrogen Products Committee, and a letter of appreciation has been received from the Ministry of Munitions acknowledging the services which the Institution rendered in this important work.

In response to a request from the Ministry of Transport, the Council has nominated members to represent the Institution on the advisory panels from which committees of the Ministry are selected.

The annual accounts show that there is a margin to the good on the revenue account for 1919 of £1,495, which amount compares with £1,270 in 1918, an increase of £224. The assets stand at £141,212, against liabilities of £43,222, leaving a surplus of £97,990, an improvement of £6,241 on last year's figures.

The annual report of the Committee of the London Students' Section states that the Council considered all Students' papers read in the years 1915-19 for the revival of the award of premiums, which was made at the end of last session as follows:—A premium of £10 to Mr. R. L. Smith-Rose, B.Sc., and premiums of £5 each to Messrs. A. G. Everett, R. T. Fleming, R. Gates, E. A. Guthrie and A. G. Ramsey. In future the Council has decided to award three premiums of the value of £15 each. In the present session these have been awarded to Messrs. C. E. Webb, B.Sc., E. T. Norris and J. Scott-Taggart, M.C. The British Electrical and Allied Manufacturers' Association has offered prizes of £10 each for papers by Students suitable for publication in the B.E.A.M.A. *Journal*.

NEW PATENTS APPLIED FOR, 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

12,156. "Electrolytic manufacture of metallic sulphides for use as vulcanising pigments." C. O. Griffith. May 3rd.
12,169. "Electric machines for perforating designs in paper, leather, fabrics, &c." H. H. Gilbert and J. H. Morley. May 3rd.
12,181. "Means for operating diaphragm horns." J. Etchells. May 3rd.
12,182. "Electric switches." J. Etchells. May 3rd.
12,215. "Apparatus for self-regulation of dynamos running at varying speeds." A. H. Blezard. May 3rd.
12,222. "Spark plugs." J. Iacono and S. E. Page. May 3rd. (United States, November 27th, 1918.)
12,225. "Devices for controlling electric discharges through gases and vapours and methods of operating said devices." British Thomson-Houston Co. (General Electric Co.). May 3rd.
12,229. "Time-controlled circuit-controllers." G. L. Hall. May 3rd.
12,231. "Means for arranging electrodes in vacuum tubes." Edison Swan Electric Co. and J. Scott-Taggart. May 3rd.
12,263. "Electrodes for electric batteries, &c." A. Pouchain. May 3rd.
12,264. "Negative electrode for electric accumulators." A. Pouchain. May 3rd.
12,273. "Fittings or sockets for electrical conduits." J. Jagger. May 4th.
12,275. "Electric light fittings." W. S. T. Hards. May 4th.
12,279. "Electric lanterns." Efandem Co. and A. H. Williams. May 4th.
12,285. "Indicator for electric bells." C. Loversidge. May 4th.
12,291. "Telephone systems." Automatic Telephone Manufacturing Co. (Automatic Electric Co.). May 4th.
12,305. "Magneto motor." D. Suchostawer. May 4th.
12,307. "Arrangement for production of sustained electrical vibrations for wireless telephony and telegraphy, &c." Soc. Independante de Telegraphie sans Fil. May 4th. (France, November 5th, 1919.)
12,312. "Telephone systems." Western Electric Co. May 4th. (United States, May 5th, 1919.)
12,332. "Electric switches, &c." H. E. Donnithorne. May 4th.
12,334. "Air-cooled electric motors." M. J. Peltz, M. Stamm and H. Tucker. May 4th.
12,338. "Remote-control circuit-breakers, &c." J. Hall. May 4th.
12,342. "High-voltage distributors for electrical ignition apparatus." Akt. Ges. Brown, Boveri et Cie. May 4th. (Switzerland, May 14th, 1919.)
12,343. "Arrangement of distributor brush-holders in magneto-ignition apparatus for internal-combustion engines." Scintilla. May 4th. (Switzerland, May 15th, 1919.)
12,345. "Thermostatic apparatus." W. Moon and J. Kiell (executors of C. E. Hearson). May 4th.
12,352. "Devices for cooling electric machines." P. Ehrmann. May 4th. (France, April 4th, 1919.)
12,372. "Electric crucible ovens." C. Soncini. May 4th. (Italy, April 25th, 1919.)
12,375. "Starting devices for internal-combustion engines." R. Bosch Akt. Ges. May 4th. (Germany, February 13th, 1915.)
12,389. "Electric cooking apparatus." S. Percival (De Matteis Broiler System Co.). May 4th.
12,402. "Electric operated hammers." S. W. M. Kollock. May 4th.
12,407. "High-speed telegraphy." J. Swinburne. May 5th.
12,435. "Vacuum-cleaner electric cord take-up." B. J. Tamarin. May 5th.
12,439. "Electrically-driven winches." W. H. Scott. May 5th.
12,456. "Electro-chemical de-rusting and cleaning process." Emesco, Ltd. May 5th.
12,473. "Reversing of alternating-current shunt motors." Siemens-Schuckertwerke. May 5th. (Germany, April 8th, 1914.)
12,476. "Methods of transmitting wireless messages." Siemens & Halske Akt. Ges. May 5th. (Germany, April 24th, 1918.)
12,480. "Electric vehicles." R. Scaby. May 5th.
12,481. "Electric furnaces." British Thomson-Houston Co. and G. J. Ralph. May 5th.
12,482. "Slow-motion devices for electric rheostats and controllers." British Thomson-Houston Co. and J. Sugden. May 5th.
12,488. "Directing electric waves in wireless telegraphy, &c." F. J. B. Cathcart. May 5th.
12,506. "Telephone exchange systems." Western Electric Co. May 5th. (United States, August 17th, 1916.)
12,515. "Starting device for internal-combustion engines." R. Bosch Akt. Ges. May 5th. (Germany, July 14th, 1915.)
12,522/3. "Electrical contact-makers for steering-wheels of motor-vehicles." J. L. Scott. May 5th.
12,525. "Telephones." T. M. Inman and The Relay Automatic Telephone Co. May 5th.
12,529. "Electric tail lamps for motor cars, &c." E. Jones. May 6th.
12,533. "Electric switches." E. Cunningham. May 6th.
12,549. "Protective apparatus for alternating-current systems." C. C. Garrard, A. E. McColl and A. H. Railing. May 6th.
12,567. "Electrodes for secondary or storage batteries." J. M. Allen. May 6th.
12,584. "Means for insulating circuits and for supply of electricity to circuits." A. R. Angus. May 6th.
12,586. "Method of fixing electrodes to insulators of sparking plugs." W. R. Marshall. May 6th.
12,592. "Electric tumbler switches." W. Manchester and M. J. Railing. May 6th.
12,593. "Recording mechanism for electrical sign telegraphs." H. K. Harris. May 6th.
12,599. "Method of driving electric centrifugal machines having mechancial unloaders." W. Hunt (S. S. Hepworth & Co. and E. M. Mackintosh). May 6th.
12,616. "Manufacture of electric wires and cables." H. Deraugе. May 6th. (France, December 23rd, 1919.)
12,656. "Electric tramway safety guard for trolley." J. & R. F. Ellis. May 7th.
12,662. "Electro-deposition of iron alloys." S. O. Cowper-Coles. May 7th.
12,669. "Electrical fuses." F. Whipp. May 7th.
12,670. "Electrical terminals." F. Whipp. May 7th.
12,678. "Improving cutting qualities of razor blades, &c., by electricity." T. F. Gaynor. May 7th.
12,682. "Means for amplifying sounds of receivers of telephonic, &c., instruments." F. H. Gordelier. May 7th.
12,701. "Process of manufacture of perborates by electrolysis." H. G. C. Fairweather (Fredriksstad Elektrokemiske Aktieselskabet). May 7th.
12,712. "Means for advancing and retarding spark in internal-combustion engines." C. A. Vandervell & Co. and W. G. Ward. May 7th.
12,716. "X-ray plates." A. L. Landau and L. A. Levy. May 7th.
12,717. "Systems of electric ship propulsion." British Thomson-Houston Co. (General Electric Co.). May 7th.
12,718. "Electric heating devices." British Thomson-Houston Co. (General Electric Co.). May 7th.
12,720. "Means for drying ink and discharging electricity in printing." W. H. Chapman. May 7th.
12,754. "Means for transmitting electric current to electrically-driven motor vehicles." C. G. L. Judge. May 7th.
12,775. "Electric gramophone." A., S. T., W., and W. J. Keast. May 8th.
12,788. "Sparking plugs." H. B. Ransom and F. J. S. Thomson. May 8th.
12,798. "Portable electric lamps." J. H. Berry and D. W. John. May 8th.
12,808. "High-frequency signalling systems." British Thomson-Houston Co. (General Electric Co.). May 8th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

15,468. Wireless telephone systems. British Thomson-Houston Co. (General Electric Co.). October 30th, 1916. (141,386.)

1917.

6,932. Electric motor control systems. British Thomson-Houston Co. (General Electric Co.). May 15th, 1917. (141,387.)

1918.

20,557. Railway signalling systems. McKenzie, Holland & Westinghouse Power Signal Co. and T. J. Hornblower. December 10th, 1918. (141,402.)
20,757. Electrical firing of explosive mines. J. L. V. da Cruz. December 17th, 1918. (141,404.)

1919.

396. Miners' safety lamps. G. & J. Oldham. January 6th, 1919. (141,409.)
1,115. Sparking plugs for internal-combustion engines. V. Joly. January 5th, 1919. (141,435.)
6,760. Electric transformers. H. S. Binns and Ferranti, Ltd. March 18th, 1919. (141,480.)
7,102. Arc lamps. S. E. Crick. March 21st, 1919. (141,483.)
13,290. Sparking plug. W. U. R. Goreham. May 27th, 1919. (141,539.)
14,409. Mixed manual and machine-switching telephone exchange systems, and the designation of subscribers lines therein. Western Electric Co. and G. Deakin. June 6th, 1919. (141,550.)
15,335. Means for mounting electrodes employed in the prevention of corrosion in steam boilers, condensers, and the like. A. S. Gush. June 18th, 1919. (141,559.)
17,216. Electrical fire-alarm systems. E. C. R. Marks (Spardon Electrical Products Co.). July 9th, 1919. (141,577.)
18,027. Apparatus for converting direct electric current into high-frequency alternating current. A. W. Dale. July 18th, 1919. (141,584.)
18,522. Wireless direction-finding apparatus. C. K. Chandler. July 25th, 1919. (141,587.)
19,377. Electric switches. E. M. Hewlett. October 31st, 1918. (134,519.)
23,345. Sending-keys for electric telegraphs. H. Roberts and F. J. Matson. February 19th, 1919. (Divided application on 130,359.) (141,604.)
29,140. Moulds for the manufacture of glass-insulated sparking plugs for internal-combustion engines. C. E. Gerbaud. November 22nd, 1918. (141,607.)